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ELEMENTS OF SCIENTIFIC PURCHASING

A THESIS

Submitted to the Faculty of the School of
Business Administration of Boston University
as a partial requirement for the degree of
Master of Business Administration

BY

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CHAPTER I

INTRODUCTION

The problem of choosing a thesis subject that is worthy of being considered as of graduate calibre is not an easy task. Many theses have been written by candidates for bachelor, master, and doctor degrees on nearly all phases of business. Some of these theses have been good - others not. Some have been written on subjects that have been discussed times innumerable. Many have been prepared by simply restating principles and truths that have been uttered by many authors and teachers. A comparatively few theses have been written as the result of really original study and research into phases of business.

The writer of this thesis has felt that in choosing a subject he should endeavor to study some phase of business from which he would derive value, and which would lead him into fields not already covered in the class-room courses taken while an undergraduate and graduate student. Feeling thus toward the thesis required as a partial requirement for the Master of Business Administration degree, I some time ago began casting about for a subject which would require original thought and research rather than simply a rehashing of other persons' ideas.

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In "Elements of Scientific Purchasing" I found a subject in which I was interested and which has not as yet received the attention to which I believe it is entitled. This conclusion was reached in the following manner. Some eleven or twelve years ago I was employed as a production clerk and later as a cost clerk by a large machine manufacturing concern in greater Boston. Some years later I had to do considerable buying of supplies for an educational institution. Looking back over the experience of these two positions I saw how important purchasing was and began to appreciate the value of and actual necessity for the application of scientific principles to purchasing. I then wondered if there had been much material published on this subject. After searching through book catalogs and magazine indices I was much surprised at the paucity of information available. In fact, I have failed to find to date more than three books which treat the subject of purchasing in a scientific way and none of these exhausts the subject by any means. Magazine articles which discuss purchasing constructively are few in number. It seemed that this subject, then, would offer the writer an opportunity to apply what poor talents he might possess in studying a phase of business which has been sadly neglected by most writers and students. Moreover, the treatment of a subject like this will result in a nearer approach to the type of thesis which is most to be desired; namely, original study and research.

I will attempt to show that scientific purchasing is a necessary function of modern business, an outgrowth of the rapid expansion of business during the recent decades. Moreover, I am sure it will be proven that the purchasing agent is as important to the success of the modern manufacturing concern as is the sales manager or factory superintendent. In addition, I will try to establish beyond question of doubt that the purchasing agent, to function properly, must be a trained executive of high caliber - not a subordinate clerk without responsibility.

After considerable study in preparation for writing this treatise, I began to wonder why purchasing had not been put before on a scientific basis. Consideration of this question convinced me that two points were involved. In the first place, scientific purchasing was not necessary until the American policy of mass production had become an established fact. In the second place, other problems of manufacturing pushed themselves forward as being of greater immediate importance.

If we look back over the history of business to the times before the Industrial Revolution we find that what manufacturing existed was done in the household. This was true of all such important operations as even spinning and weaving. Moreover, each family was able, and of necessity forced to be, self dependant. What was not made in the home for home consumption was made in the households of master

workmen. Hand labor is slow labor and the materials consumed were relatively small in quantity. Purchases were in small lots and because of the unsettled conditions of business each purchase was by inspection and "dicker". Practically all manufacturing if we can term it such, was for custom work rather than for sales stock. This practice made scientific purchasing impossible because manufacturing itself was not scientific in the sense we know it today.

In England, the Industrial Revolution brought about the beginnings of scale production, but in so doing it created other problems more pressing than that of buying materials, for one of the results of the new era was the lowering of prices of materials. The rapidity with which new inventions and new processes were thrust upon the market resulted in constant turmoil among manufacturers and workers. The idea of large scale production under a factory system was new. Capital had to be collected. Workers had to be trained to an entirely new order of working and living conditions. In any social or industrial structure that can be considered as approaching the satisfactory, there must be a balance between three elements: population, resources, and technique. Under the craft system the population had been adjusted to the available supply of resources and to craft technique. Under the new system technique changed to such an extent that it was out of balance with the available supply and population. As a result of the new technique supply increased

much more rapidly than demand. It is obvious that under these circumstances the newly created capitalists were given the terrific problem of either increasing demand or controlling supply. This could not be done effectively because of the lack of organization among manufacturers and the constant changes in technique. It did create, however, a number of associations of manufacturers who because of glutted labor markets were able to force down wages, thinking that lower prices would sell more goods but not considering the fact that low wages and high food prices reduced purchasing power to the minimum. Demand could not be increased because of the low purchasing power at home and because of the lack of a safe foreign market. The manufacturer therefore tried to control supply.

In American during the period of settlement, the problem was slightly different. Here was a virgin, sparcely settled country. The population was scattered over a wide area with very poor means of communication. There were few communities which could support more than one or two workers in a particular craft. One very important difference existed between the Old and New World. In the Old World, land was the basis of wealth. Immigrants to the New World, imbued with Old World ideas of the value of land, were impatient to acquire title to land and were not at all anxious to follow a trade. It was actually necessary for many of the colonies to subsidize certain of the skilled crafts in order to persuade

the skilled craftsmen to work at their trades in the towns instead of taking land. This scarcity of skilled workers resulted in the development of what has been described as the itinerant type of worker - a travelling journeyman moving from job to job and town to town. Gradually as towns and cities grew up and the demand for craft work became more pronounced the itinerant worker developed into a custom worker more permanently located. He now opened a town shop where he made articles at the order of his customers. With the further expansion of town life the custom-order-proprietor developed into the retail shop-keeper. He was now both a merchant and master workman and while at first he worked part of the time at the bench, he gradually devoted all his time to the retail end of the business and hired others to do the bench work.

Slowly but gradually, a portion of the retail merchants developed into manufacturers and wholesalers and we find the manufacturing done by other than the local retailer. At this early stage of development the manufacturers were faced with the problem of getting their products to the consumer over poor transportation systems and with the problem of keeping down production costs. The latter could most easily be done by bucking labor. On the other hand, labor could move from town to country for new land was always available to those who wanted it. This ability to move tended to

maintain equilibrium of population and because of new settlements permitted the manufacturers to develop new markets. As the nation grew business expanded until in the last quarter of the nineteenth century the country could show a fairly satisfactory balance between population, available resources and technique. Manufacturers had become accustomed to looking for greater markets but distant markets made necessary interchangeable parts and standardized production. As a result they developed more highly than had ever been done by the manufacturers of any other country the practice of mass production which now makes it possible for a man in California to send to New York for some little part of a machine knowing that when it comes it will fit not only his own machine but any other of the same make and model. This development of the mass production idea, so necessary in a country where an article was to be used two or three thousand miles away from where it was produced, required untold thought and effort to produce standardized manufacture and precision of workmanship. Was it not in itself a Herculean task requiring every effort of the manufacturer who hoped to compete successfully? The writer is not one of those who necessarily believes in the inherent superiority of Americans over other peoples but it must be admitted by everyone that no nation has ever tackled a bigger job. But as is often the case, the accomplishing of this task created

another which was to get rid of the product of this mass production. This obviously meant that sales had to be increased and we have seen how this work has been studied and accomplished through scientific salesmanship.

As long as civilization continues we will be faced with the problem of doing business better than the other fellow. In America we have reached the point where we have established a balance between population, technique, and available supply. As our population grows, so must the other two. Technique has been developed to a highly efficient stage and will continue to develop. Supply, especially that of raw materials, will receive more attention in the future than it has in the past. While we have devoted much consideration to the problems of labor costs, processes of manufacture, and demand creation, we have not paid as much attention to materials. In the future more now than ever before, we must devote attention to the problem of getting materials of the right kind at the right time and at the right price.

CHAPTER II

IMPORTANCE OF BUYING

Is the buying function important?

If this question was asked of a group of business men the answer in almost every case would be in the affirmative. If, however, we changed the question to "Is the buying function important enough to justify a department organized to do all purchasing and nothing else?" the answers in the affirmative would not be so numerous. The question is not one that can be answered quickly or easily. There are industries where material costs are an insignificant part of the total, labor and overhead being much larger in dollars and cents. On the other hand, we find businesses where a large part of every dollar of sales is made up of 75 or 80% of materials and 20 to 25% of labor, overhead, and profit.

At first thought we might say that in the first case materials form such a small part of the value of the manufactured product there is little or no need of a separate purchasing department - that a purchase clerk could perform the routine of placing orders, checking merchandise received, tracing shipments, etc. under the direction of the general manager, factory superintendent or treasurer. Likewise, we might at first thought feel that a purchasing agent was indispensable in the second case. Unfortunately the problem is not so easy to solve. Suppose for example the first company uses a material that has a wide range in price, the

price dependant largely on economic and political conditions over which the manufacturers have no control. It may be that the company will find it profitable to engage a man to watch for these economic or political changes to try to forecast their happening and to buy the materials when prices are low. Let us assume the second concern mentioned above uses primarily one raw product, that one product having but a slight fluctuation in price range and in addition being bulky or expensive to store. As will be shown later, cost of storage space is important and this one factor may force the firm to buy from hand to mouth.

No, we cannot answer the question so simply. We can, however, consider the case of a concern manufacturing a product which requires iron, steel, copper, brass, in raw, semi-finished, and finished form. In addition suppose the firm produces its own power, generating its electricity by steam turbine driven dynamos and generators. A manufacturing concern of this type would also consume large quantities of supplies other than those just mentioned such as cutting and lubricating oils, coal, gasoline, belting, shafting, tool stock, etc. Many of these items fluctuate considerably and irregularly in price. No man can act as general manager of a large concern with all the problems of a varying nature which confronts one in such a position and still keep in close enough touch with prices to purchase to the best advantage. The same would be true in the case of other officials.

But, you say, let the order clerk gather information and lay it before his chief, the latter to decide when the order will be placed. This argument will not hold because a clerk of ordinary ability would not know what to look for. His chief interest would probably be in the "price" which may be of slight importance. He could not recognize as important many factors of an economic nature which a man trained in economics would recognize instantly. On the other hand if the clerk by any chance did have the training and judgment which would enable him to judge of these things intelligently, he probably would not care to work as a subordinate of one less versed in such matters, and what is more important why make a subordinate of a man who by training, intelligence and work done is worthy of being given responsibility? Why take the time of two men to do the work of one?

There are many manufacturing concerns where buying is done by several persons - in other words by the heads of the departments who will use the material. This practice is often costly. It is the condition which is found in retail stores but in the retail store the buying of one department is in the hands of one man for a definite reason. For example, in a department store the head of the shoe department (known as the buyer) purchases all shoes that are to be sold. He would never be expected or allowed to buy drugs or automobile

accessories. His job is to determine what his customers are most likely to buy in the shoe line and then to acquire the goods at the best possible terms. Where in a manufacturing concern like the one above purchasing of materials is done by several persons, duplication is bound to occur. Foreman A orders, we will say, five kegs of $1\frac{1}{4}$" x $4\frac{1}{2}$" hexagon head machine bolts with square nuts. Foreman B orders the same bolts but with hexagon nuts. Two orders have been placed and probably will be billed separately. Two sets of entries must be made by the accounting department. The cost will be between $450 and $500. If this is a supply for a long time and it in most cases would be for this is an odd size of bolt, it will mean an unnecessary increase in inventory. The chances are that either square or hexagon nuts would do in either case. One order would have sufficed with the result that office work would be reduced, inventory would be reduced one-half, and stock room space saved.

Let us consider the seller and his reaction to decentralized purchasing. Suppose the X Company sends their salesman, Mr. M, to this concern. He goes in to see Foreman A who at that moment is helping a new lathe hand set up a machine. When A is free he talks to Mr. M and gives him an order for the bolts mentioned above. Mr. M then goes to see Foreman B whom he finds in an argument with a draftsman as to whether or not a drawing is correct. By the time this

argument is settled and perhaps lost by B, which does not improve his temper, B tells Mr. M he doesn't want anything. Mr. M has spent half a day talking with two men in one plant. If he had to deal with one purchasing agent he would know that by seeing one man whose job it was to see salesmen he could get the same or a better order in one-third to one-sixth of the time and be free to call on other concerns. It is obvious which type of selling will cost most per dollar of sales.

One fact that is often lost sight of is that the selling expense of a concern is added into the sales price of its merchandise. No firm gives away selling expense. Naturally then it becomes plain that purchasing by several individuals costs the seller more and he in turn will be obliged to make up this extra cost by charging higher prices either directly or indirectly.

Purchasing then is a function of importance wherever the materials used are of a quantity, or quality that results in (1) varying prices of (2) available supply or (3) where the same materials are used in more than one department. The purchasing department is especially effective where the materials have a range in price. Too often we are inclined to think that the price of basic commodities is not subject to variation as are the prices of other commodities not so commonly used. This is not always true and as an example

I have listed below the average annual prices of pig iron per long ton as shown by government reports from 1901 to 1925 inclusive.[1]

1901	$15.93	1910	$17.19	1918	$36.67
1902	20.67	1911	15.71	1919	31.09
1903	18.98	1912	15.94	1920	44.39
1904	13.76	1913	17.13	1921	25.34
1905	16.36	1914	14.84	1922	27.58
1906	19.54	1915	15.78	1923	28.68
1907	22.84	1916	23.86	1924	23.29
1908	17.07	1917	43.64	1925	22.33
1909	17.49				

The graphical presentation of this data on the following page shows the wide fluctuation even more clearly.

Here is a commodity that is the basis of a large percentage of our industrial life. Is there any doubt as to the value of devoting considerable attention to this one commodity?

The writer has in mind a concern which manufactured an automatic stoker made largely of cast iron. Each stoker contained about fifty tons of metal. These machines were an assembly of practically rough castings, the labor item was almost negligible.

If we will look at the prices of pig iron we find a marked upward movement in 1921, 1922, and 1923. Some firms

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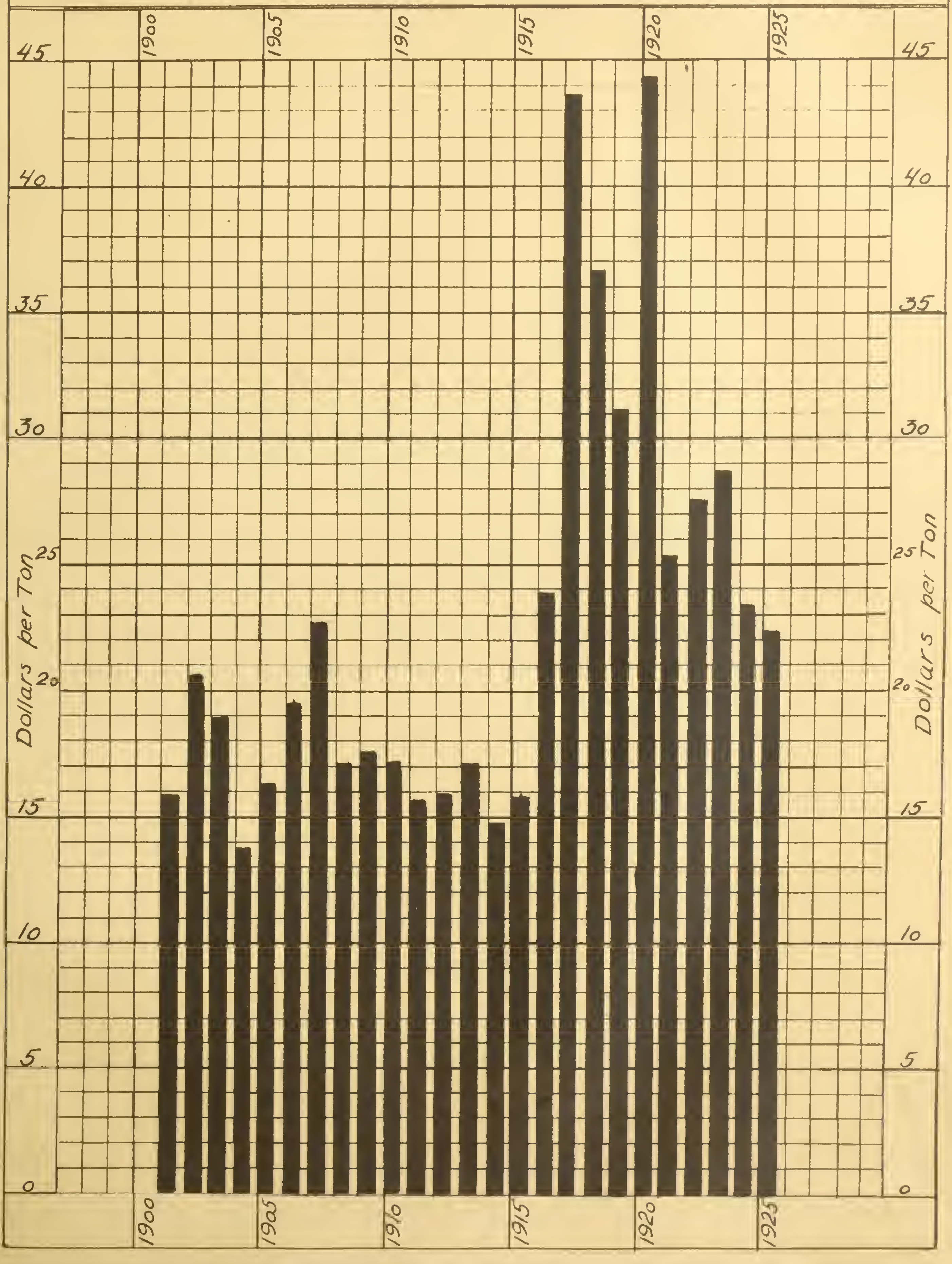
1. Reference #1 - page 724

Iron Prices


1900
1905
1910
1915
1920
1925
45
40
35
30
25
20
15
10
5
0
Dollars per Ton

noted this increase in price and felt that the upward trend would continue. They, therefore, placed two and three year contracts for pig iron at what to them seemed to be favorable terms. In 1924, however, there was a marked fall off in price. If the stoker manufacturer mentioned above had placed a long termed contract based on 1921 prices it would have paid in 1924 and 1925 over one hundred dollars per machine for raw material alone in excess of 1924 prices and $250 if based on 1923 prices. When this is considered in its relation to inventory costs, etc. the amount is increased and one can readily see what would have happened to this concern especially when it is known that its market was being seriously threatened by another stoker of the same general type but of lighter construction made by a new concern which was buying from hand to mouth.

These few examples have been given to prove the importance of separating the purchasing function from other departments. The problem of watching prices is one that cannot be done carelessly or intermittently. Prices must be watched constantly if the firm is to see price movements before they occur. Plotting curves of prices as they occur can be done by any one. To be able to plot the curve of prices before they happen is a different story. In most cases, except for certain general tendencies of seasonal trend, there is no definite movement in the cycle of prices that can be used

to tell very far in advance what prices actually will be. But the gathering of data on price cycles, economic factors, financial conditions, tax policies, governmental control, labor conditions and labor legislation may enable a man who devotes all his time to the problem to evolve certain truths which, when applied properly, will enable him to forecast prices reasonably accurately in the majority of cases. One devoting his time to this subject certainly can do a better piece of work than one who is interested in other phases of the firm's business.

There is another duty so closely allied to purchasing as to make it necessary to put the two together. That is the problem of stores. Unless the purchasing agent can have control of stock, any good work he may do in the way of buying at the right price may easily be lost. In the event goods are bought at the proper price but are put into stores without being properly checked as to quantity or inspected as to quality the price saving is of little worth. Still more important is the matter of the amount of stock to be carried. It is not an easy task to save a thousand dollars in the price of materials but it is a very easy task to consume a thousand dollars in size of stock rooms, stock clerks and the carrying charges for inventory. Factory foremen and superintendents are primarily concerned with the smooth running of their departments and know the trouble

which will result from a failure to have materials available when they are needed. They often are not familiar with the cost involved in carrying inventories and if they are acquainted in a general way with these figures they are swayed by their more intimate problems and fail to appreciate that an average of twenty-five dollars excess stock on each of three thousand articles (which is a reasonable number of items for many types of concerns when various sizes, qualities or shapes of articles are considered) means seventy-five thousand dollars of working capital tied up in excess stock. It is therefore desirable that the stock rooms should be under the control of the purchasing agent.

We can divide the operations of an industrial concern into four parts or functions. These are (1) producing, (2) distributing, (3) financing, (4) accounting. I consider these four functions each to be divisible into the following groupings. Production is concerned with producing the right goods at the right price. It is only common sense that if the factory does not produce salable goods at a salable price the best of distribution plans will be of little avail. Production then must concern itself with obtaining workmen and processes which when given the proper materials can produce salable goods. Training workmen and studying processes will require the entire energy of the factory superintendent. The technical knowledge needed to operate his plant efficiently, the time required to keep in touch with

new processes and inventions will not leave him much leisure. His job then is to produce right goods. The purchasing agent has the job of getting the proper raw materials to be consumed. What constitutes the proper raw materials will be discussed later. Materials properly bought and worked on by the proper workmen in the right way will result in right goods at the right price.

The goods are now turned over to the distribution department whose work is to get these goods to the right place at the right time. This is done through advertising, salesmanship, etc. The function of financing of course involves the providing of fixed and working capital to make possible the operating of functions while the accounting function is to prepare the statistical data that must be the measure of past performance and the guide of the future. From the above the writer presumes to make a statement which he considers to be the rule for the success of any business. This rule is that the right goods at the right price at the right place at the right time equals right sales.

As we are to concern ourselves in this paper to the consideration of the purchasing functions it seems wise at this point to consider the relation of the purchasing department to the other departments in the organization. I think I have already shown that the purchasing agent can be of material help to other department heads by relieving some

of them from the necessity of performing a function not within their immediate field. I consider that a purchasing agent must be willing and able to cooperate with his associates. We hear a lot about the "game of business" but often fail to realize that the team play of baseball, football, basketball or hockey is just as important in industry. The slightest discord or lack of cooperation results in lost efficiency. No job in an industrial organization calls for greater tact in dealing with associates and outsiders than does that of buying. The fact that the technical factory man has a real and practical knowledge of what he wants, that the sales manager knows what he can sell, that the treasurer knows how much money he has to meet current obligations and the comptroller has a knowledge of the future financial outlook that suppasses his own is a point the purchasing agent must never forget. It is his job to cooperate with each and every individual in the organization with whom he comes in contact just as much as it is their job to cooperate with him. With these facts in mind we are ready to consider in more detail the necessary elements that make up successful purchasing.

CHAPTER III

QUALIFICATIONS FOR SUCCESS - PROFESSIONAL ETHICS

Every job or profession calls for certain personal qualities if it is to be handled or followed successfully. Many of these qualities are common - others are of greater importance in some positions than in others. Now and then we find a calling that calls for a peculiar characteristic that is not of vital importance in other fields of activity. This condition is rare, however, and not a problem in the case of purchasing agents unless we consider a perfectly balanced personality a peculiar characteristic. As we look around us we may conclude that this is the case for we will find few people who are not lacking or overdeveloped in some one quality.

The writer is not a student of ethics nor has he ever studied psychology so perhaps he is not qualified to submit anything relating to the subjects covered in this chapter. I will, however, as a layman offer for consideration certain facts that have impressed with their importance. I was first of all rather surprised to see how much personality entered into the work of the purchasing agent. One is inclined to think at first that the buyer for a large concern is in a position to be friendly or grouchy, smooth tempered or hasty with salesmen wishing to sell him materials. In addition to this he can be arbitrary or cooperative with the factory

or the accounting department for is he not in an advantageous position? The salesmen cannot sell goods to his concern unless they take whatever treatment he gives them, nor can the factory workers get material to work unless he buys it for them.

This is all true and there is no question but that a purchasing agent will be successful regardless of his personality so long as he "delivers the goods". Unfortunately he will not - in fact he cannot hope to - "deliver the goods" very long unless he conducts himself properly and treats others fairly. As proof of this let me illustrate by an example given me by a brass salesman. This man acts as a selling agent among the firms throughout metropolitan Boston. A short time ago he received word that there would be an advance in price on all bar stock effective on all orders taken after the next day. The next morning he called purchasing agent B of the L Co. told him of the increase in price. He suggested that the buyer check over his stock and order anything he needed even if he wanted to defer delivery. Agent B did so but did not call up until the next day when the new prices were in force and asked if he could still place an order at the old prices. The salesman told him that he could, that the salesman upon not hearing from him had taken a chance and placed an order for a certain weight of brass bars, sizes to be specified later.

While he was telling me this the salesman did not know I was acquainted in this district. I knew B and thought perhaps as he was considered a large buyer that the salesman was especially anxious to keep his goodwill. I therefore asked the salesman if he ever sold to buyer C - of the S Co. to which he replied yes and went on to say that this concern used from 50 to 75% more brass than the L Co. I then asked him if he hadn't called O - about the change of price and he replied no, that O - never treated salesmen decently, was always trying to cheat them and was entitled to no considerations. Knowing O - as I did I was in perfect accord with my salesman friend's attitude.

It is most unfortunate but nevertheless a fact that the shop force of a manufacturing plant is suspicious of and antagonistic to the office. Nor can we truthfully say that this feeling is all one sided. We need not discuss here the reasons for this feeling but we must recognize its existence and appreciate that efficiency of operation is impaired in direct ratio to the existence of this feeling. There are always those who in the regular performance of their duty will stir up this feeling unintentionally as when the cost department or payroll department start setting new piece rates. It is costly to all and if it is allowed to grow reflects itself in the profit and loss statement. In the purchasing agent we have an individual who must remember this feeling exists. He must watch every move he makes measuring its effect of the shop force.

Let us consider now some of the individual characteristics. I suppose no one quality is more often stated as being necessary to success in any line than honesty. It hardly seems necessary to say that a man's word should be as good as his bond, but some do not seem to sense its importance. If the purchasing agent tells a foreman that an article, which had been requisitioned two weeks before, has been ordered when it has not, he may not do any serious harm but sooner or later by a process of accumulation the news will get out that the buyer's word is no good. The unfortunate part of it is that suspicion is aroused as to the sincerity of his other characteristics and he no longer can accomplish his best no matter how hard he tries. Later while discussing ethics the matter of honesty in dealing with those outside the organization will be discussed.

Sometimes we find people who in trying to be honest only succeed in being blunt. While bluntness at times is very effective, it often is detrimental to good will between individuals. Tactfulness must be the keynote of each and every contact that is made. This is simply another way of saying "treat others as you would be treated". Remembering that salesmen are human and that their job is to sell should make a purchasing agent appreciate the value a soft refusal or an explanation politely given of why the salesman lost the order. The time spent in explanation of why the order

was placed elsewhere may make it possible for the salesman to quote more intelligently in the future.

Often we are forced to call upon some individual and approach him with dread for we never know how he will feel. That man handicaps himself. How much more fortunate the man whose disposition is always the same, who can be relied upon to have an even temper. That second man will probably be friendly - not familiar but willing to listen and learn. The friendly person always has a chance to pick up information that may later be of value. Often a few minutes spent with a salesman will give a purchasing agent a thought that later may result in a saving to the buyer's firm. When a salesman finds a friendly man not ready or interested in buying his product he will often relax and talk honestly about business, his product, or new processes he has heard about. These are the things the buyer is paid to know.

There is an old saying "Familiarity breeds contempt". This may or may not be true but there is a question whether or not being friendly to the point of familiarity is wise. I believe the average purchasing agent will do well to eliminate familiarity when dealing with outsiders and simply be friendly in a quiet, sympathetic, but businesslike way. When dealing with co-workers the buyer because of the closeness of his association with them may find that there are cases where it is profitable to be more familiar. There

are persons who can best be handled by jollying and by being laughed out of some of their prejudices. Whether the agent finds it advisable to be familiar or not he must be friendly to his associates and subordinates. While the purchaser gets a lot of information from the outside he obtains more detail from his own organization. If he is not friendly with co-workers he can hardly expect them to tell him what he wants to know or to give him honest advice when he asks for it.

This leads us to another characteristic of importance: namely, broadmindedness towards the whims of others and toward new ideas. How easy it is to say that a person is unreasonable and refuses to listen. But suppose a foreman wants to use square head bolts on a job. These are not stocked and he insists on having square head bolts instead of hexagon head which are carried in stock. Apparently a meaningless whim but if not handled properly may result in an antagonistic foreman. A few minutes time spent with this man letting him tell all the reasons why he wants square head bolts and then a reasonable discussion of how the hexagon heads can be used, and the extra cost of square heads under the present conditions will generally result in two things. First the hexagon heads will be used and it will not be necessary to stock a new item and second the foreman will feel he has had a fair deal.

The above discussed qualities are of real importance but the successful buyer will have a large stock of common sense. We need not here go into more detail. Nor do we need to do more than mention the necessity for initiative: that quality so necessary for success in any vocation. The ability to foresee future trends or events from what is occurring at the present time is of major importance and suggestions as to how this may be applied will be discussed in a later chapter.

There is one qualification for success that is open to considerable debate as to its importance. Harriman in his "Principles of Scientific Purchasing"[1] is constantly emphasizing the need for technical knowledge. He implies that a purchasing agent must know products and processes as a trained engineer if he is to buy those products intelligently. It seems to me that this is going farther than is necessary or even desirable. It seems more logical to me to recognize the limitations of the average successful business man and engineer. If we do this we must face the truth of the statement that no man can know everything. It is the duty of the purchasing agent to be a practical economist, one who can recognize and interpret every day events in the light of their economic effects. He must then translate his findings into terms of finance, production and sales. If he has been trained to adequately perform this duty it

1. Reference #2

is doubtful if he will also have found time to acquire a thorough training in engineering.

But suppose our purchasing agent has been trained as an electrical engineer. It is probable that his thermodynamics and heat engineering courses do not qualify him as a final judge of the relative merits of two kinds of coal as well as though he was a chemical or mechanical engineer. Then, too, is there not a danger that as a trained engineer he will be swayed in some cases by the quality rather than by the utility (quality, service, price) of the article. This question of utility is of great importance and will be discussed later. It seems to me more important that he be trained as an economist than as an engineer for the chances are very heavy that the engineers of the plant will be capable of passing on the technical quality of any product to be purchased.

I do not mean to belittle technical training as a desirable qualification nor do I wish to imply that it is unnecessary. On the other hand I believe technical knowledge is important and must be acquired to a certain degree if the purchasing agent is to perform satisfactorily. I do believe however that business training is more important than technical. The fact remains, however, that a certain amount of technical knowledge must be acquired to buy intelligently. How dangerous it would be when discussing the placing of a contract for brass castings for a purchasing

agent who did not know the effect of antimony on brass composition to have the salesman suggest a slight change in the alloy. Of course the buyer might wait until he could see the engineer in charge and ask him if the suggested change was possible. In a case of this kind it probably would not be advisable but there are cases when a slight change in material might be advantageous but the buyer without technical training would have difficulty in recognizing what was worth bringing to the attention of the engineering department and what was not.

This is important. Many times engineers make a standard as the one to be followed simply because it is the method or standard they are accustomed to. A technically trained salesman from another concern which specialized in this work may know of another method or standard which will be less expensive. If the purchasing agent can tell him what the article is expected to do and can recognize the merits of the salesman's proposed method as giving the same results he can transmit the new suggestion more intelligently and accurately to his own engineering department for approval. To the wise purchasing agent, salesmen will always be a source of information not only to him but also through him to his associates.

Regardless of whether the buyers technical training is large or small there is need for him to learn all he can.

He may of course follow out a definite plan of study from text books but he will probably find that more up-to-date and varied knowledge will be found in technical magazines and house organs. Articles in technical magazines are fairly reliable and often those in house organs are also - at least they are worth reading. If the purchasing agent will keep in mind that many of these articles are written for publicity or for sales and not believe that all he reads is the absolute and whole truth he will find much valuable training. To illustrate what I mean I am going to quote two articles which appeared in the November, 1929 issue of "Black and "White" the house organ of E. F. Houghton and Co. of Philadelphia. This company is one of the oldest and most reputable manufacturers of belting, packing, and lubricating, quenching and cutting oils in the United States and their products are sold all over the world. A mechanical engineer told me that the first article was one of the best he has seen on a very important subject in that it is a clear, simple and truthful statement of the whole problem. Of course it does not go into minute detail and all the ramifications of the problem but it does state the principles involved and that is all it is intended to do.[1]

"Local Case Carburizing"
H.A.Schwartz

> "It is, no doubt, needless to say that the process of case-hardening was developed in order to produce steel objects differing in properties at the surface as compared with the center. More specifically, the practically universal purpose is

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1. Reference #3 pp 3-7

to produce an object whose surface shall be hard, and, therefore, unavoidably somewhat brittle, but whose center shall be adequately strong and tough to resist the static and shock stresses to which the article as a whole may be expected to be exposed.

"This result is obtained, as we all know, by impregnating the surface of an article made of low carbon steel with additional carbon. This carbon is derived, in general, from carbonzceous packing materials with which the object is covered and then heated to about 1700° F. (926°C.), at which temperature the migration of carbon will proceed.

"The presence of carbon in the case is effective in two ways. First, because the physical properties of high-carbon steel of given heat treatment differ from those of low-carbon steel of the same heat treatment. Second, because the carbon content determines the critical range, more specifically the A_3 point, of the steel so that a casehardened part can be quenched from a temperature which is above the A_3 point of the carburized surface and below the A_3 point of the low-carbon core. In consequence, the surface may be quench-hardened with relatively little quench-hardening of the interior portions.

"For our present purpose, the question of the heat treatment necessary for grain refinement may be omitted in the interests of simplicity. Nor will this article concern itself with the casehardening of objects, usually of special steels, by the action of nitrogen on the surface metal.

"Casehardening is always a local effect, in so far as we may distinguish between the casehardened surface as a whole and the interior as a whole. Now, from time to time, it is desirable to produce casehardening which is localized not with respect to the surface and center only, but with relation to certain parts of the surface.

"For example, we may desire to harden only certain portions of the surface of a shaft. A

case of this kind is required where the part is to be in contract with bearings, or is part of the surface of cams forming an integral part of the shaft. Under these conditions, the rest of the surface must not be as hard as the casehardened area, in order to avoid the possibility of harmful results due to the spread of cracks caused, etc.

"Then, the purpose of the present article is to discuss rather briefly the principles upon which results of this character may be obtained.

"As outlined briefly in the foregoing paragraphs, it is plain that the carburized case is harder than the remainder of the part because of two associated causes. First, the presence of additional carbon, and, second, the application of the heat treatment calculated to harden these higher carbon zones. It follows, therefore, that if we wish to prevent casehardening at some particular portion of the surface, it will suffice either to avoid the addition of carbon at these areas or to avoid a heat treatment of the character to produce the hardening effect in the portions not to be hardened.

"For example, if we wish the surface of one half of the length of a shaft to be hard while the surface of the other half to remain as is, we may do one of two things. Either we may so arrange matters that the end of the shaft which is to remain soft is prevented from absorbing carbon, or we may so conduct our heat treating operation that only the end to be hardened is subjected to quenching. Obviously, we will have still greater assurance of producing the desired result if we can differentiate between the two ends, both in regard to carburizing and subsequent heat treatment.

"The problem of producing a different heat treatment on different heat treatment on different parts of the surface of a case carburized object is quite similar, in principle, to problems encountered in connection with the hardening and tempering of carbon tool steel parts. The question involves the possibility of heating the object locally, at the places which are

required to be hardened, and then quenching the object as a whole; or else of heating the object throughout and quenching only those areas where hardness is desired.

"Quite a considerable number of cases exist where such local heat treatments are applicable. Usually, electrical methods of imparting heat are best adapted to local heating. Local quenching is accomplished either by partial immersion in the quenching tank or by the use of liquid or air jots impinging upon selected portions of the surface. Occasionally, local quenching is produced by attaching pieces of metal or other material of fairly high heat capacity, and preferably of low diffusivity, to the object to be quenched. These protect the parts underneath from rapid cooling when the assembly as a whole is immersed in the quenching liquid.

"An example of such practice occurs when, before hardening, drilled holes in a part to be hardened are filled with asbestos, fire clay, or sometimes with metal plugs in order to avoid the action of the cooling medium on the inner surface of the holes. Procedures of this character are, however, hardly to be considered examples of differential carburizing but of differential heat treatment. There remains for consideration, therefore, the question of producing local hardening without special modifications of the quenching treatment.

"The simplest and most effective means of reaching the desired end is one which is not very frequently used, and sometimes impracticable. It depends upon the fact that before quenching the case carburized surface is fairly machineable. If, then, this is the case, and the piece when submitted to the carburizing operation has sufficient stock left on it at the places where softness is desired, it is possible, after case carburizing and before hardening, to machine off the carburized layer where the hardening is not desired.

"For example, if the center of a shaft is not to have a hardened surface while bearings near the ends should have, then, first, we may machine a shaft whose diameter in the central

portion exceeds the finished diameter by more than twice the thickness of the case which is to be applied. The shaft, having been carburized and cooled slowly, then can have the central portion turned down to the size finally desired. By this means the carburized surface will have been removed, and a suitable heat treatment for hardening the case then can be applied to the shaft as a whole. This will be effective only in those places where the case carburized surfaces remain.

"Similarly, if we desire to make a casehardened plate, which after casehardening must be capable of being drilled in certain locations, we can finish the original steel object with bosses at the location of the drill holes: the bosses rising from the surface by an amount several times the thickness of the proposed case. These bosses can be milled or planed off after carburizing but before hardening. When the piece is hardened soft spots will be left in the desired locations.

"However, here again, we have evaded the main issue in that we have not actually produced differential carburizing but mechanically removed preexisting carburization. To understand the principles upon which any workable process of differential decarburization must depend, it will be well to reflect upon the theory of carburizing.

" Of course, in practice, a great deal of carburizing is done in solid packings. These packings usually consist of carbon mixed with various chemical compounds whose function is one of activation.

"Now, while it is true that, at appropriate temperatures, soft steel will take up carbon from carbonaceous material actually in contact therewith, this is not the procedure by which carburizing actually takes place in practice. If it were, the process of local carburization would be very simple. We would merely clamp blocks of carbon or containers filled with pulverized carbon to the piece to be carburized, covering only the spots which

are to be hard, and no hardening would take place anywhere else. Actually, however, the carbon absorbed by the iron is not taken directly from the carbonaceous material of the packing but from carbon monoxide, resulting from the action of air and of the decomposition products of the activating material on the carbonaceous material of the packing.

"Thus, carburization is a reaction between iron and gas. The local application of carbonaceous materials to surfaces to be carburized can be effective only if the circulation of carburizing gases to portions of the objects other than those to be hardened is in some way minimized or prevented.

"At any given pressure, there is for each temperature a particular gas composition representing equilibrium in the carburizing reaction. If, at the temperature in question, gases lower in carbon monoxide, and, hence, higher in carbon dioxide than this equilibrium concentration, are in contact with iron, some of the carbon of the carbon monoxide enters the iron by the reaction

$$2CO = C \quad CO_2$$

Thereby, a certain proportion of carbon monoxide is converted to carbon dioxide. The composition of the gas is shifted in the direction of an increased amount of CO_2 and the reaction goes on until a gas is formed in which the ratio of CO to CO_2 is that corresponding to equilibrium.

"If, on the other hand, the gas originally has more CO_2 than is required by the equilibrium conditions, the reaction proceeds in the opposite direction if the CO_2 can find carbon in the surface of the metal with which it can combine according to the reaction $CO_2 \ C = 2CO$. It is the function of the carbonaceous material and of the activating agent of the packing to keep the composition of the gas such that there is always more CO than is required by the equilibrium with cementite.

"Changes of pressure affect the equilibrium compositions in such a manner that at low total pressures, for a given temperature, a higher

concentration of carbon monoxide is required for carburizing than if the pressure be increased. It follows, therefore, that carburizing under pressure accelerates the reaction. Further, that the dilution of the carburizing gases by an inert gas, such as atmospheric nitrogen, decreases the tendency to carburize.

"If the oxygen of the air, by combining with CO, will shift the gas composition in a direction unfavorable to carburizing, the rate of carburizing is changed. Hence, parts of objects not embedded in the carburizing material carburize less readily than those which are in the packing. This is because air or the products of combustion in the furnace atmosphere gain access to the parts where the packing does not exist, and, thereby, contaminate the gas phase in a manner which minimizes its carburizing action. It appears, therefore, that we should be able to produce local carburizing by any means which will permit us to prevent access of carburizing gases to the metal surfaces where hardness is not desired.

"There are two distinct means for securing this result. One consists of coating the portions of the surface not to be carburized with an adherent layer of any substance which is impermeable, or but poorly permeable, to gases. Perhaps, the neatest way of securing this result is by copperplating. Copper adheres well when plated on soft steel. It can be localized on the desired surfaces quite readily by first coating the entire object with paraffin or wax, and then scraping away this waxy layer where the surface is to be soft. Upon subsequent electroplating, copper will be deposited only upon the surfaces where there is no wax. Then, during the casehardening operation, the wax on the coated parts will burn away and the exposed surfaces will be subjected to carburization by the gas of the carburizing pots.

"If, by chance, copper has been accidentally deposited on places where carburization was desired, it can be removed readily with nitric acid. Copper is slightly permeable to the carburizing gases, but the process described is perhaps as successful as any in securing the desired effect.

"Alternatively, we may paint the surfaces to be protected with an adherent material of

refractory character, and so prevent the access of gas. Sodium silicate, with or without additions of other materials such as asbestos, is perhaps the most efficient way of securing this result. Borax, fused on hot metal, forms a very adherent layer almost like an enamel and perhaps has merit. Indeed, any material which may be considered as an enamel over the parts to be protected would be applicable.

"All these materials are merely protecting layers calculated to prevent contact of the gas with the iron. Still another method is to use a chemically active material which can be painted on the surfaces to be protected from carburization. The chemically active ingredients of such materials are metallic oxides, such as iron oxide.

"They may function merely by virtue of being impervious to the carburizing gases, but, beside this, they may react with the carburizing gases in accordance with the equation

$$Fe_2O_3 \quad CO = 2FeO \quad CO_2.$$

Thus, they destroy that constituent of the gas upon which we rely for the deposition of carbon into the metal. Since they are themselves destroyed in the process, there is a limit beyond which they cease to be active and no longer furnish protection.

"An instance of this form of protection (although in this case the protection is undesirable) occurs where rusty objects are casehardened, or objects from which the scale has not been completely removed after forging. The locations where rust or scale formerly existed are frequently found to be softer than the rest of the material, and rejections of casehardened parts of this kind are not infrequent.

"A mechanical difficulty to be considered in producing local carburization in rotating furnaces concerns the question of adhesion of the protective material. Any material which is to resist carburization also must be of a character to survive the rolling action of the parts in tumbling inside the rotating furnace. If the coating material flakes off during rolling in the furnace it ceases to perform any useful function.

> "In some instances, carburization with hydrocarbons leads itself very readily to local hardening. Some of the processes for case-hardening armor plate derive the carbon content from hydrocarbon jets impinging on and flowing over one surface of a hot plate. The gases do not reach the other side of the plate, that is to say, the side which will be inward when in use. Only the outward face of the plate is carburized and hardened by subsequent quenching.
>
> "Of course, such processes do not permit very close control of the boundary between the hardened and unhardened surface of an object, but are quite convenient where one side or one end is to be hardened: the exact place where the hardening ceases being relatively unimportant."

On the other hand the very next article was said by a chemist to tell the absolute truth but he could not agree that it was the whole truth.[1]

> "Why the Transparent
> Cutting Coolant?
>
> "The development of metal cutting media from lard oil to the highly efficient water soluble transparent cutting media of today, resulted in part from the demand, during the World War, for increased speeds and feeds in machining operations. This demand led to an intensified study of metal cutting operations. Older conceptions, or rather misconceptions, of the theory of metal cutting were abandoned, and it was conclusively shown that a metal cutting coolant should not function entirely as a lubricant, but largely as a coolant.
>
> "The function of a lubricant is to prevent friction by separating two moving parts by a film. In metal cutting, however, it is absolutely essential that the tool come into direct contact with the metal. The use of a lubricant merely tends to prevent this contact.
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> "For many years, a mistaken idea was held that the heat liberated during the metal cutting resulted from friction between the tool and the metal, or the tool and the chips. This is only

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1. Reference #3 - pp 24-25

partly true. While a certain amount of heat is generated from this source, tests have shown that not more than 10% of the heat generated can be traced to this cause.

"The cutting of metal is essentially a shearing action. The heat generated is not heat of friction, but heat of shear; that is to say, it is generated by the tearing apart of the metal. This, of course, is not interatomic heat, but the liberation of energy which held the atoms together.

"Needless to say, the most efficient coolant is of no value unless it remains on the work, and on the point of the tool. In order to insure this condition, the coolant must possess "wetting out" properties.

"This can only result when the cutting coolant is water soluble and forms a true solution, and not an emulsion. It has been proven that the greater the colloidal dispersion of the cutting coolant, the more evenly distributed is the film.

"In view of these facts, it is interesting to consider the various cutting media which have been advocated and used in the past, and to trace the way in which they have given place to the transparent water soluble cutting media of today.

"The great standby in the metal cutting industry in the past was lard oil. As is well known, lard oil has excellent lubricating properties. Unfortunately, however, the refrigerating properties of lard oil are conspicuous by their absence. It does not absorb or carry away the heat of shear in sufficient quantities to keep the tool cool. In consequence, the tool loses its edge, and, thereby, actually increases the heat generated by shearing.

"Examine the chips as they leave metal which has been machined. When chips are blue, it is a positive indication that the coolant is not acting efficiently. Of course, there are certain jobs on which lard oil combinations can be used. However, even here the use of a more modern cutting coolant is desirable.

"From a purely theoretical standpoint, it would appear that water would be an ideal metal cutting coolant. As a matter of fact, water has the desired "wetting out" properties, and is an excellent refrigerant. Unfortunately, however, it lacks the necessary lubricity. Realizing this, an attempt was made to produce metal cutting media with emulsifiable oils. Such metal cutting media were marketed under the name of "soluble cutting oils." This term is a misnomer, for the reason that they do not pass into solution with water but merely form an emulsion, which is milky in color and obscures the work.

"Another attempt to solve the metal cutting problem was made by making soapy solutions with water. The objections to such solutions were that they tended to rust the tool, the machines and the work, which occasioned serious delays and shutdowns. They had neither lubricity, nor film strength to prevent metal-to-metal contact of the chip passing over the face of the tool. This resulted in excessive tool wear.

"As the result of this experience, manufacturers attempted to incorporate soap into these so-called soluble oils. These experiments were not successful because the natural properties of the fat are destroyed in the saponification with strong alkali.

"The problem which next confrontes the industry was the preparation of an entirely new metal cutting coolant. It was well known that such a coolant must have the following properties:

1. Refrigeration
2. Lubricity
3. Rust-preventing properties
4. Must not attack the skin of workers and produce skin sores
5. Must form a true solution which will not separate, or decompose on standing.
6. Should not obscure the work during the metal cutting operation, and, for this reason, should be transparent.
7. Must be readily soluble in water and not require any special precautions during mixing.

> "Of these properties, the most significant is that of being transparent.
>
> "From the standpoint of operating efficiency, the transparency of water soluble cutting media is significant because it allows the workmen to view the work during all stages of the cutting operation. Greater ultimate significance, however, lies in the fact that it is an indication of special physical properties in the cutting coolant itself.
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> "In order to obtain transparency, a cutting coolant must contain the refrigerating oils, etc., in a state of extremely fine colloidal dispersion. This, in itself, is an indication of a colloidal solution of the cutting oil and water, and not a mere emulsion.
>
> "Experience has shown that transparent cutting coolants having this remarkably high colloidal dispersion have better "wetting out" properties, and better refrigerating properties, with efficient lubricity. Their use enables the operator to work closer to size. This results in fewer rejections due to poor finish.
>
> "Due to the exceptional refrigerating properties of these transparent solutions, greater cutting speeds and feeds are possible. Tool grinding is less frequent, and the machines are kept free from rust and require less frequent cleaning.
>
> "From these considerations, it will be seen that transparency in cutting media is not merely "just another physical property," but an indication that the cutting media have essential requirements for metal cutting. It is for this reason that the transparent, water soluble cutting media may be regarded as "the last word."

It was interesting to note that in the middle of this latter article there was a four page advertisement of "Hocut" a "transparent water-soluble metal cutting coolant" manufactured by the E. F. Houghton and Company.

The first article was educational, the second advertising but both had valuable information.

Let us now turn our attention to the question of ethics. We are often inclined to wonder if the standard of ethics in the business world today is so very high in view of the things we see happening almost daily. If, however, we will only glance back a short space of time to when "caveat emptor" was the principle of doing business we appreciate that advancement has been made. There is no need trying to fool ourselves into believing that business is wholly without ethics or that it has reached perfection. The saying "business is business" is absolutely true. Business is not play nor war nor religion. Business is not carried on primarily for pleasure; nor is it a finish fight based on ignorance, intolerance, and hatred; nor is its chief motive the salvation of the participant's soul after death. Business is carried on for the making of money and for no other purpose. Carl F. Tauesch in his book "Professional and Business Ethics" states this situation emphatically and points out that anyone in business is bound to recognize this truth and assume the responsibilities involved when he says:

"When business men refer to the parable of the talents as an apology for their activities, they never ask whether the man who had one talent was performing useful services

to society and therefore was incapacitated from increasing his store. But they do point to the gains of the man with ten talents as an index of his contributions to society. That is, in the last analysis, the measure of business success; nor is it any disparagement of business activity that this is so. But the business man who does not have the convictions of his calling, who tries to conceal this fact and thereby assumes principles other than his own, is worthy of nothing short of condemnation. How can he possibly reconcile his activities with his assertions? He need only read the parable of the rich young man to discover what he needs to do if he is not satisfied with the honest and sincere motives of the business man. Service and gain are often incompatible. This does not mean that the moral excellence of one implies the moral reprobation of the other. It does prevent, however, anyone from identifying himself with both values. To choose business as a career, to pursue its activities, and then to fail to accept its responsibilities and to be ashamed of its purposes - certainly this will bring business into disrepute more than any amount of immoral and unethical conduct of its votaries."[1]

Tauesch does not contend that ethics are lacking or undesirable. He does wish to bring out the fact that the ethics taught in religion and the ethics practiced in

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1. Reference #4 - page 259

business are not yet the same. There is little question however but that one of the reasons for modern industry's rapid growth has been due to the general recognition of the dollars and cents value of honesty and fair dealing. Whether we realize it or not it is ethics of a definite standard which gives us confidence to wire a stranger in Seattle to ship us in Boston a carload of lumber of certain size and grade. Here we are dealing with a man whom we have never seen and buying something without knowing whether it is as represented except for someone else's word. And don't forget the stranger is risking a lot in shipping such a valuable product three thousand miles to a person unknown to him. Of course you can say that the law protects both parties - the buyer may sue if the lumber is not up to specification and the seller may sue if he is not paid. This is true but what good would the law be if it was a general practice to ignore the ethics of doing what you agree to do?

The last few years have seen the organization of many chambers of commerce and trade organizations. These organizations have invariably issued a "code of ethics" at the time of organization or shortly after. This practice has been fostered and agitated by such organizations as the United States Chamber of Commerce, Rotary Internation and similar associations.

"What the Chamber of Commerce of the United States and Rotary International purposed when they worked out and published their 'Principles of Business Conduct' and 'Code of Ethics' respectively, was to encourage separate and distinctive business associations and organizations to modify these broadly phrased rules in accordance with their particular industrial problems - - - - - - - -. In this purpose the Chamber of Commerce and Rotary were not disappointed (page 262). Hundred of codes have been adopted by business organizations and trade associations, many directly as the result of the impetus given by the two main sponsoring organizations, and many others indirectly because of their activity."[1]

Naturally the adoption of a code of ethics by an organization to which Mr. B. belongs does not mean that Mr. B. is bound to live up to that code. When Mr. B., however, learns that his associates endorse certain principles he will often in order to hold their respect unconsciously be influenced by their example. It is only natural that in the course of time ethics in business will feel the result and standards be raised.

It used to be the customary thing for the purchasing agent to receive graft in the form of entertainment, gifts, etc. The present generation of buyers or at least those

1. Reference #4 - page 261

who are making good recognize that this is something which cannot be indulged in. Give the salesman no reason to expect favors from you and it will be easier to say no when the time comes.

Another practice that has grown less popular than in former years is that of taking a cash discount after the discount period has expired. This change in attitude is largely due to the objections raised by the sellers but the modern purchasing agent also has recognized that a cash discount is a financial saving that must be earned or paid for. If it is earned then it is a saving but if it is taken when not earned the seller must sooner or later add it into the selling prices of his goods.

Another abuse of discounts has been and still is the practice of misrepresenting to the seller the quantity of goods he may expect to sell. To illustrate, Buyer A expects to use 1500 units of a certain article in a year. He learns that the price is $7.60 per unit for lots of this size but $7.50 for lots of 2500. He therefore tells the salesman that he intends to try out 1500 units and if they are satisfactory he will place another order in six months. Of course he refuses to sign any agreement or to bind himself in any way but by implication he induces the salesman to quote him the $7.50 price. Some may look upon this as sharp practice and say he is a clever buyer

but is he? Suppose he tries the same stunt again with the same concern. He probably will not get far. Moreover the salesman will talk with salesmen of other houses dealing with this buyer and all will be on their guard not only against this particular thing but also against any other trick to which he may subject them.

Another practice that is going out of style is that of telling a bidder that you have a quotation lower than his, that you like him and want him to have the order and suggest that he submit a new bid. If there is a lower bidder this may be true. If it is true and he can do it without injury he did not give you a fair bid to start with and is not entitled to the favor. But if he is the low bidder it is simply doing one of two things - either he is going to lose money (which he might do once and recover but not often if he is to stay in business) or he is going to deliver an inferior product. In either case the buyer loses for the other bidders will soon cease to look for his business or his own concern will have an inferior product to work with.

It would seem that ethics are necessary and worth money. Dealing fairly with others invites fair treatment and there is no place where the "Golden Rule" is worth more in dollars and cents than in the work of a purchasing agent.

CHAPTER IV

CHOOSING THE ARTICLE

In the preceding pages, I attempted to prove that purchasing forms an important element in the manufacturing of goods. I also tried to show that the functions of buying materials had not been placed on as scientific a basis as had other functions and that here was a real opportunity for more efficient purchasing than has been the general practice in the past. If this is all true then it was necessary to discuss the relation of the purchasing to other departments in the organization. To further show how a purchasing department could function effectively with other parts of its own organization and deal with those outsiders it came in contact with, I discussed the vital traits of character needed by a purchasing agent and some of the ethical questions which will confront him.

It would seem proper for us now to consider some of the technical features of scientific purchasing. Of course the first question which comes to mind is "What article shall I buy?" This in itself presents a large problem but it is not the only one. The buyer must answer other questions as well, such as "When shall I buy it?" - "What is it worth?" - "What shall I pay for it?" - "How shall I find it?". It is my intention in this chapter to discuss the first and last

questions: namely, "What article shall I buy?" and "How shall I find it?".

The first step in choosing the article is to know what you want it for and what you expect it to do. This information as will be shown later can be learned from specifications so let us assume the buyer has this and other information and is ready to buy. It is necessary to find out where the article can be bought. Of course it will be a simple thing to look up previous orders and simply inquire of those concerns who have sold you before but this obviously is not enough for articles bought only at rare intervals, and certainly it is useless if the articles have never before been purchased.

In any event, even when purchases are made frequently, it is of great importance that the buyer know as nearly as possible every source of supply. This is desirable for several reasons. In the first place it may happen that the firms from which you have bought in the past may, if located in the same locality, suddenly find themselves unalbe to maintain output because of labor difficulties. Then again some firm you have not dealt with before may refine some process of manufacture thereby producing as good or better merchandise than you have been getting. Another factor of importance which the writer has found from actual experience to be true is the need of keeping the seller from feeling you are a sure customer.

While the other factors are obvious this last matter is not so clear but means this. Many firms after finding that they have the edge on competitors for your business do not go to as much pains to quote the lowest possible price. This is wholly unintentional for they want your business and are perfectly honest but they may roughly revise former quotations rather than actually figure on each job. As illustrative of this point the writer calls to mind a printing concern in Boston who did catalogue work for a certain house seven or eight times in three years. The writer who was acting as a sort of purchasing agent discovered that their prices had increased much more rapidly than seemed reasonable. When the contract was awarded to another concern the salesman for the first company was very much disturbed and asked for a reason. When he learned how great the increase in price had been he was very much surprised and after investigating gave the above explanation for the increase. Needless to say future quotations were more carefully prepared.

The question now becomes, "How shall the buyer learn of and keep informed of the sources of supply?". Let us first consider the problem of an article being bought for the first time. The United States Department of Commerce and Labor will be only too glad to supply a list of manufacturers or sources of supply for almost any commodity.

Then there are the trade organizations who can refer you to their members producing the article you want. Then, too, the source of information that will yield the quickest results is the advertising sections of technical, professional and popular magazines. If the purchasing agent will tabulate the information obtained from any or all of the sources he will have a fair knowledge of where to look for what he wants.

While preparing to write this thesis the writer interviewed a buyer for a large concern. This man is successful and efficient in most respects but in one he appeared to be sadly lacking. He wanted to illustrate a certain point by referring to a catalog. He looked through the pile of literature on his desk, called in his secretary, looked in the quotation file, in the order file, in a closet in his office and finally concluded it must have been lost. It was evident that catalogs did not receive very courteous treatment in that office.

Catalogs are valuable. They are constant sources of information on many questions and should be handled systematically. Unfortunately, they do not lend themselves to easy filing for they vary greatly in size and shape. "One drawback to adequate catalogue filing is the great variety of catalogue sizes in existence. If a uniform size prevailed, it would be simple to devise a plan for filing catalogues

according to the commodities with which they deal. A commendable movement is afoot to standardize the size of catalogues. It has been endorsed as one of the national simplification movements by the United States Department of Commerce and it is supported by architects, engineers, purchasing agents, and other business groups, but it will probably be several years before the purpose of the movement is attained."[1]

It is generally possible, however, to sort catalogues into a few general sizes which will permit reasonable ease in filing. Then by numbering the catalogues in each file and having a key letter for the file (such as A-1, A-2, A-3, etc. for the largest size file and B-1, B-2, B-3, etc. for those of the next size) it is possible to keep all catalogues systematically arranged. Then prepare a card index (one card for each catalogue giving the number of the catalogue, the name and address of the firm and at least the main classifications of products listed. This card arranged alphabetically by firm names permits the quick selection of their catalogue from all those on hand and also shows the general type of product they offer. This record should be supplemented by another which will be an alphabetical index of articles listed in the catalogues together with the catalogue and names of manufacturers. It may seem at first thought to be a lot of effort to prepare and maintain such a record but only experience with and without it can prove its great value.

1. Reference #5 - page 82

The above has shown us the sources of information of where we can buy. Other elements of this question will be discussed later. Let us return to the main question of What to buy.

We must now consider the factors which will determine our field of choice. In the past price has been considered the very important item in choosing the article. It was commonly considered that the buyer who secured materials at the lowest cost was the best buyer. Some firms actually measured the efficiency of the purchasing department from this fact alone. To do this they debited the Raw Materials account for the cost of the goods purchased. As materials were drawn the requisitions were figured at the present market value and this was credited to the Raw Materials account. To illustrate this let us assume a thousand units were bought at six cents. Three hundred were used when the market price was six and one-half cents and two hundred when the market price was seven cents. The account would be as follows:

Raw Materials

60.00		19.50
		14.00
	Inventory at cost	30.00

The quantity on hand at the end was figured at cost. It will be seen that the market price of those used was $3.50 more than cost and so it was considered to be a profit earned by

the purchasing department. On the other hand, if the market price at time of withdrawal from stores was below cost the difference was considered a loss to be charged against the purchasing department.

This policy placed so much emphasis on the matter of price that in many cases it became all important. Inferior materials were purchased, resulting in poorer finished products, increased labor costs due to the need of more machining, greater waste because of increases in scrap, etc. Price is not the only factor to receive attention when choosing the article. "Appropriateness, quality, service and price are the buying factors, and their relative importance is in the order indicated."[1] This quotation is given here as the key to the entire problem of successful purchasing. The whole process of successful buying revolves around these four factors. Note especially that Mr. Harriman uses the term "factor". In other words he definitely emphasizes the point that each is a part of the problem and must be considered as such.

The first factor, appropriateness, has to do with the adaptability of the article to the use to which it is to be put. Obviously this is primarily a problem belonging to the engineering or shop forces rather than to the buyer. The technical expert with his knowledge of what the material is expected to do and the forces tending to destroy it to

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1. Reference 2 - page 28

which it will be subjected is in a position to say what will be needed. If, as is quite likely to be the case, he specifies an article which is not a standard product in that it varies slightly from those found in the market the buyer should ascertain if it is absolutely necessary that this special article be used. The engineer is a designer not a buyer and cannot be expected to know the market. He has designed for his concern the best machine he can. Let an intelligent buyer go to him and show how cost of manufacturing will be reduced by changing specifications and most engineers will be willing to do what they can. Many times the sales manager should be considered for he ought to know what can be sold and for what price and unless the product is salable what good is it? It sometimes happens especially when the designing engineer is not a shop trained man that he will specify a metal which cannot be machined as easily as another. A word from the shop superintendant may result in a slightly different chemical content which while not effecting the efficiency of the article will result in reduced labor cost.

It is evident therefore that appropriateness is not a question to be decided by any one or two men. It is a problem for many and calls for cooperation between all departments. The determination of what is appropriate influences every phase of the business. It is the object

of every worth-while concern to produce a better article at less cost than can be made by competitors. The sales manager feels that he cannot sell more units because the product is not good enough. The shop says they do the best they can with what they receive to work with, and the buyer says the materials specified are too costly while the designing engineers claim that the buyer is unwilling to buy good materials, that the shop employes poor workmen and the sales force is inefficient. When these four departments combine and after weighing all the problems of production and distribution decide that such and such materials are to be used much will have been accomplished toward the common aim of all of them, that is, more business.

Having decided appropriateness it is necessary to draw up the standards and specifications by which materials will be ordered. This point will be discussed later. It is more important that we proceed to the second factor in buying - that of quality. Naturally, quality has been determined by the study to determine appropriateness but that is only half the job. Not only must the quality be determined but it must be maintained. All the decisions in the world regarding what the quality shall be will be absolutely worthless unless something is done to make sure that the decisions are enforced and goods of the proper quality are actually delivered. As for example it is decided that the company shall buy certain steel shafts cut and

turned to a particular size but not splined for the locking key. Let us further assume that the diameter is to be 3-7/16" plus or minus 0.0001 meaning that the size is 3-7/16" but may vary one ten-thousandth of an inch. In the eyes of modern machining this is a large variation. If, however, the variation of 0.0001 is not checked and shafts with a variation of 0.0002 or more are accepted the shop immediately will suffer. All bearings and hubs have been made to take shafts of the specified size and here are a lot which vary. Naturally more machining is necessary which means greater labor costs. Any lowering of quality must be determined and stopped for invariably it costs money somewhere along the line.

Nor is it desirable to check materials to see that they are up to quality only. Care must be taken to see that they are not above the standard set. It sometimes happens that a vendor is unable to supply the exact quality of article ordered and rather than cause a delay in delivery he will ship goods of a superior nature. This is bound to happen from time to time and the seller should be given credit for endeavoring to render service. But suppose it becomes a habit for him to ship better material than is necessary. One of two things is true. Either he is losing money or you are paying too much. In either case the situation is wrong. If you are paying for No. 2 quality and receiving

No. 1 the seller is losing money which means that he is probably in danger of bankruptcy. This condition is unhealthy for all because each business failure resulting in loss of employment, curtailment of production, and increased credit losses affects business as a whole. If the second situation exists and you are paying for and receiving No. 1 quality when No. 2 is just as well suited to your needs you are paying more than you should for your material. Goods must be inspected and the quality determined upon must be maintained.

The third factor, service, refers primarily to the ability of the vendor to perform satisfactorily. Delivery at the time specified is of real importance. If the merchandise is received ahead of time it will be in the way. If this is not the case it is possible that too much space is devoted to Stores which means that fixed charges such as rent, insurance, taxes, etc. are larger than they need be. Also payment for the merchandise will probably date from time of shipping which means money tied up in inventory that much longer. Remember that idle stocks of materials are like dollar bills in a safe deposit vault - they earn nothing and cost at least the rent of the box. But of still greater importance is the need to have the material delivered on time. A few hours delay in delivery may disrupt the whole production schedule for modern manufacturing demands that

each process be performed and the product passed on to the next department on schedule time. This means that when one process or part gets behind schedule the whole process of manufacture is thrown out of time. The resulting confusion and rushing around to get back on schedule is nerve-wracking and its cost cannot be measured in dollars and cents alone.

Then, too, we have the more common use of the word service in that we must measure what the seller can do for us if we need him. It is not enough to know a certain machine is appropriate, and the quality is satisfactory. We must also remember that we may need a repair man on that machine in the future and we must be assured that we can have one with reasonable promptness. The losses resulting from poor service are obvious and need not be discussed here.

Price is the fourth factor. To many this seems of great importance but if appropriateness, quality, and service are to be considered price must be considered last of all. Obviously, in an industry where there is competition the purchasing agent who wished to do his part toward meeting that competition cannot pay more than his competitors for any article unless it has greater value. We are too prone to confuse the words value and price and think of them as meaning the same thing. Price means the cost in dollars and cents while value is the worth of the article to any one person. While the price may be the same to all the

value may be much greater to one than to another. It is of vital importance that the purchasing agent buy on value rather than price and that he determine value by the four factors discussed. The method he uses to weight appropriateness, quality, service, and price to determine value will be the real test of his ability. Relative strength, appearance, processes in fabrication, processes of manufacture performed in the shop versus processes performed by other concerns for the shop, selling price of finished product all enter into the consideration of what price we will pay. A competitor may buy brass oil cups for thirty cents and buff and nickel plate them in his own plant. Our concern may not have enough of this work to justify maintaining a buffing department. Therefore it is plain that our concern must buy oil cups that have been nickel-plated if appearance is an important factor.

It is also important to bear in mind that nothing is free in this world. Everything must be paid for either in effort or money. The buyer that thinks he can get something for nothing is heading straight for trouble. No reputable firm will sell at a loss very long nor does it desire to do business with a firm that is unwilling to pay for what it gets. The following quotation illustrates the dangers of looking for something for nothing. It tells what one successful man learned about purchasing.

"Price vs Quality in Purchasing"

"In his climb from office boy to president he stopped three years in the purchasing department taking over a most demoralized department. It had more favorable orders than it was possible to imagine. The company dictated the terms of all contracts and then the entire clerical force worked on making claims and settling disputes. Carpenter who had sold for several years, says 'I knew, as a seller, that those concerns who obtained the best of everything from our company were those upon whom we made a profit, and those who received the least of everything were those who had forced us down to a point where there was no particular advantage in their patronage.' Therefore, having found that the most reputable sellers were more or less indifferent to Houghton business he proceeded to inaugurate a policy by which no one-sided purchasing contracts were to be made. 'The buyer who fools himself into believing that he can deprive the seller of all profit, to his own advantage, is to be pitied rather than copied. The wise buyer of today knows that quality rather than price is the basis of economic buying. And you cannot obtain quality from price sellers. The two do not mix.'"[1]

The next problem to be considered involves the establishing of standards and the problems of specifications.

1. Reference #8 - page 51

As was intimated above this is an important part and upon it depends to a large extent the success of the purchasing agent in getting those materials which are satisfactory to the departments which will consume them.

A standard according to one definition is "that which is established by authority, custom, or general consent as a model or example". Who shall determine what shall be used as standards is not the simplest question to answer. It might seem that this was a prerogative of the engineering department but unfortunately it is quite unlikely that a technical expert without knowledge of markets, materials available, inventory problems, sales resistance, and in fact nearly every problem of administration is qualified to adequately prepare in all cases the standards which are to govern the purchasing agent in the securing of material. Instead of this responsibility for preparation of standards resting in the hands of one department it is the mutual problem of the engineering force, the purchasing department, the sales organization, and last but by no means least through the sales department the consumer.

It is perfectly obvious that there are cases where, for example, a plain brass water gauge is just as efficient and satisfactory as one which is nickle plated. The sales department may be able to prove that a few touches to the appearance of the product may tend to bring down some of the sales

resistance which is being met with and the few extra cents spent in obtaining nickle plated fittings may pay in the long run. On the other hand, the engineering department may specify that certain bronze castings shall be made of phosphor bronze. They are looking for a bronze hard enough to serve in bearings. Without question this is a suitable material but, on the other hand, bearing bronze because of a slight change in the chemical content is cheaper and except for extra heavy work will probably be just as satisfactory. No one will be in a position to recognize this difference in cost as well as the buyer.

The fourth group to whom the standards are of great importance is the shop force for upon them falls the burden of fabricating the material ordered by the engineering and bought by the purchasing departments in a manner that will produce an article which can be sold by the sales department. It should be evident from the above that the determining of standards is a job for several organizations rather than for one.

Standards must not be confused with specifications. By standards we refer to the classes, sizes, shapes, colors, and weights of articles which are to be used. In other words, we may find that instead of stocking $\frac{1}{4}$ inch machine bolts and 5/16 inch machine bolts the $\frac{1}{4}$ inch size may be eliminated and in the place of them the 5/16 inch will serve just as well. We may find, for instance, that instead of using two

or more grades of cutting oils it is just as satisfactory to use one. What shall be the consistency of that cutting oil will be determined by these specifications.

The next question that comes up is why have standards. They are desirable to the user of the article for they tend to make production more uniform. Take for example the case of eliminating the $\frac{1}{4}$ inch machine bolts. By this change it is possible to eliminate from the tool room stores the $\frac{1}{4}$ inch drills and taps used in machining and permits the stocking of one size. This means less running to and from tool rooms and possibly waiting for special drills or jigs to be made. Standards tend to make labor cost more uniform in that fewer articles needs to be obtained by the assembling department, to put together each machine completed.

The stockroom benefits in that the reduced number of articles means fewer bins, inventory cards, requisitions, and so forth. When standards are not used, it is a very simple matter for foremen or engineers to, on the spur of the moment, make slight changes in design or fittings without giving real thought to determine whether or not they are justified. When by standards the available variety of materials is limited, this becomes more difficult and as it perhaps is no longer a case of going to the stockroom and getting something a little different than was called for on the drawings it now becomes necessary to order this special material before it can be

used. As a result, since it is harder to get, more thought is given to its desirability before it is ordered. This forcing the shop to use and the engineering department to call for certain standard parts gives an opportunity for the effectiveness of each piece used to be measured. It may be found, for example, that the cutting oil which it was decided would be the standard does not prove satisfactory as a cooling lubricant for high-speed work on steel and it will therefore be necessary to get a new cutting oil. If it had not been for the standards being established it would have been improbable that the shop would have located the reason for the excessive consumption of cutters and drills. They might have laid the difficulty to the quality of tool steel or to some other cause not related to the true reason.

Standards are especially helpful to the buyer in that they tell him what is needed. Once the standard has been established he no longer has to wonder whether something else will do because he knows that other possible substitutes have been eliminated in favor of this one article. It permits the buyer to test materials, to compare their performance with what was expected of them and gives him a chance to specify definitely to sellers what he wants and what he expects it to do. Moreover, when he is definite in his instructions to sellers it gives the seller a chance to make suggestions on changes which may be mutually advantageous. To

both the buyer and the seller standards make bidding more competitive. The buyer is able to obtain more information as to true cost in comparing bids submitted on a standarized article than would be the case if standards and specifications were not used. In addition, the seller considers the use of standards to his advantage in that he is now bidding on a definitely known article and not simply sending in a price on an article which he makes while his competitor is sending in a bid on an article quite different in material or construction.

It must not be assumed that once a standard has been established it is to remain fixed. If this were true there would be little opportunity for improving situations which might occur when incorrect standards were originally established. When the repair department, for example, of the concern can report a suspicious number of failures in some particular part of the product it is time to investigate to see where the weakness lies. This having been done, it is a simple matter to prepare new standards by again calling into consultation engineering, buying, shop, and selling department representatives. Some foremen believe that the Committee On Standards should meet at regular intervals for the sole purpose of revising or checking the standards established making sure that no new products have come on the market and that no new designs of the firm's product have been brought out which would justify a change.

The vehicle by which standards are carried into actual practice are the specifications which are to be prepared for each standardized part. This is best done by the Committee on Standards preparing a detailed statement of the material, shape, size, and so forth of each part which has been standardized. The following quotation from Harrimen's book on Standards and Specifications gives the basis for preparing specifications:

"Conclusions in Regard to the Formulation of Specifications"

"1. A specification for a product should contain the fewest possible restrictions, consistent with obtaining the material desired.

"2. The service which the product is to perform, in connection with reasonably feasible possibilities in its manufacture, should determine the limitations of a specification.

"3. All parties whose interests are affected by a specification should have a voice in its preparation.

"4. The one who finally puts the wording of the specification into shape, should avoid making it a place to show how much he knows, as well as a mental attitude of favor or antagonism to any of the parties affected by it.

"5. Excessively severe limitations in a specification are suicidal. They lead to constant demands for concessions, which must be made if the work is to be kept going, or to more or less successful efforts at evasion. Better a few

moderate requirements rigidly enforced, than a mass of excessive limitations, which are difficult of enforcement, and which lead to constant friction and sometimes to deception.

"6. There is no real reason why a specification should not contain limitations derived from any source of knowledge. If the limitations shown by physical test are sufficient to define the necessary qualities of the material, and this test is simplest and most easily made, the specifications may reasonably be confined to this. If a chemical analysis or a microscopic examination, or a statement of the method of manufacture, or information from all four, or even other sources, are found useful or valuable in defining limitations, or in deciding upon the quality or product furnished, there is no legitimate reason why such information should not appear in the specifications. Neither the producer nor the consumer has a right to arrogate to himself the exclusive right to use information from any source.

"7. Proprietary articles and commercial products made by processes under the control of the manufacturer cannot, from the nature of the case, be made the subject of specifications. The very idea of a specification involves the existence of a mass of common knowledge in regard to any product, which knowledge is more or less available to both producer and consumer. If the manufacturer or producer has

opportunities, which are not available to the consumer, of knowing how the variation of certain constituents in his product will affect that product during manufacture, so also does the consumer, if he is philosophic and is a student, have opportunities not available to the producer, of knowing how the same variation of constituents in the product will affect that product in service, and it is only by the two working together, and combining the special knowledge which each has, that a really valuable specification can be made.

"8. A complete workable specification should contain the information needed by all those who must necessarily use it in obtaining the product desired. On a railroad, for example, this may involve the purchasing agent, the manufacturer, the inspector, the engineer of tests, the chemist, and those who use the product. A general specification may be limited to describing the properties of the product, the method of sampling, the amount covered by one sample, and such descriptions of the tests as will prevent doubt of ambiguity.

"9. Where methods of testing, analysis, or inspection are well known and understood, it is sufficient if the specification simply refers to them. Where new or unusual tests are required, or where different well-known methods give different results, it is essential to embody, in the

specification, sufficient description to prevent doubt or ambiguity.

"10. The sample for test representing a shipment of a product should always be taken at random by a representative of the consumer.

"11. The amount of product represented by one sample can best be decided by the nature of the product, its importance, and its probably uniformity, as affected by its method of manufacture. No universal rule can be given.

"12. The purchaser has a right to assume that every bit of the product making up a shipment meets the requirements of the specification, since that is what he contracted for and expects to pay for. It should make very little difference, therefore, what part of the shipment the sample comes from, or how it is taken. Average samples made up of a number of samples are only excusable when the limits of the specification are so narrow that they do not cover the ordinary irregularities of good practice in manufacture.

"13. Retests of a product that has once failed should only be asked for under extraordinary conditions, and should be granted even more rarely than they are asked for, errors in the tests, of course, excepted.

"14. Simple fairness requires that when it is desired that a product once fairly rejected should nevertheless be used, some concession in price should be made.

"15. Where commercial transactions are between honorable people, there is no real necessity for marking rejected products, to prevent its being offered a second time. If it has failed once, it will probably fial a second time, and if return freight is rigidly collected on returned shipments, the risk of loss is greater than most vendors will care to incur. Moreover, it is so easy for the consumer to put an inconspicuous private mark on rejected products that it is believed few will care to incur the probable loss of business that will result from the detection of an effort to dispose of a rejected shipment by offering it a second time. Rejected products should not be mutilated by the inspector, as they are the property of the vendor.

"16. All specifications in actual practical daily use need revision from time to time, as new information is obtained, due to progress in knowledge, changes in methods of manufacture, and changes in the use of products. A new specification, that is, one for a product which has hitherto been bought on the reputation of the makers and without any examination as to quality, will be fortunate if it does not require revision in from six to ten months after it is first issued.

"17. In the enforcement of specifications, it is undoubtedly a breach of contract legitimately leading to a rejection if the specified tests give results not wholly within the

limits, and this is especially true if the limits are reasonably wide. But it must be remembered that no tests give the absolute truth, and where the results are near, but just outside, the limit, the product may actually be all right. It seems better, therefore, to allow a small margin from the actual published limit equal to the probable limit of error in the method of testing employed, and allow for this margin in the original limits, when the specifications are drawn.

"18. Many producers object to specifications on the ground that they are annoying and harassing, and really serve no good purpose; the complaint is just in the cases of many unwisely drawn specifications. But it should be remembered that a good, reasonable specification, carefully worked out, as the result of the combined effort of both producer and consumer, and which is rigidly enforced, is the best possible protection which the honest manufacturer can have against unfair competition.

"19. Many consumers fear the effect of specifications on prices. Experience indicates that after a specification has pssed what may be called the experimental stage and is working smoothly, prices show a strong tendency to drop below figures prevailing before the specifications were issued.

"20. A complete workable specification for a product represents a very high order of work. It should combine within itself the harmonized antagonistic interests of both

the producer and the consumer. It should have the fewest possible requirements consistent with securing a satisfactory product, should be so comprehensive as to leave no chance for ambiguity or doubt, and above all, should embody within itself the results of the latest and best studies of the properties of the article which it covers."[1]

When the specifications have been prepared, it is often found advantageous to bind them in loose leaf book form in the so-called specification book. Copies of this book can be scattered throughout the organization and then when requisitions are sent to the purchasing department it is many times unnecessary to copy the specifications on the requisition but simply to refer to the page in the specification book which covers this particular article and possibly noting on the requisition such necessary variations as are considered absolutely essential. The United States Government in preparing specifications has adopted a standard form and the following quotation from Harriman will give not only the main headings but also a description of the subject matter contained under each.

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[1] Reference #7 - pages 146-151

(STANDARD FORM)

UNITED STATES GOVERNMENT

PROPOSED

MASTER SPECIFICATION

FOR

NAME OF ARTICLE OR MATERIAL

"(The first draft of the specification, as submitted to the board by the technical committee for circulation to the Government departments and establishments for comment and criticism, shall bear the above caption. The final draft of the specification, as submitted to the board by the technical committee, after consideration of the comments and criticisms received, shall be as above with the word proposed deleted.)

I. GENERAL SPECIFICATIONS.

"In this section reference should be made to any applicable general specification and drawings forming a part of the specification, with a statement that such general specification and drawings form a part of the specification. This section serves as an index to the documents which must be considered to permit a complete interpretation of the specification.

II. TYPES, GRADES, CLASSES, ETC. (as applicable).

"In this section should be listed the several types, grades, classes, etc., of articles or materials covered by

the specification, preceded by the words: '......shall be of the following types (grades, classes, etc.).' If only one type, grade, class, etc. is required, it should be so stated. The types, grades, classes, etc. (if more than one) should be listed under a brief name convenient for reference and in accordance with commercial practice, and, whenever practicable, should be designated by capital letters or arabic numerals. The same designations should be used under Detail Requirements, Section V, and under Methods of Inspection and Tests, Etc., Section VI, if applicable, so that Section II will serve as an index to the subject matter of the specification.

III. MATERIAL AND WORKMANSHIP, ETC.

"Under this heading should be included any necessary requirements relative to the character or quality of the materials used, the method of manufacture, and workmanship. Any requirements with reference to the use of scrap should be here stated.

IV. GENERAL REQUIREMENTS.

"All essential requirements and descriptions which are applicable to the articles or materials and which are common to all of the types, grades, classes, etc. covered by the specifications should be stated in this section. Tolerances permitted, if common to all types, grades, classes, etc. should be included. If spare parte are required for all types, grades, classes, etc. they should be here stated.

V. DETAIL REQUIREMENTS.

"In this section the items listed in Section II, Types, Grades, Classes, Etc., should be considered consecutively, when practicable, using the name and designation in full, detailing for each, such physical and chemical requirements, characteristics, and descriptions as may be necessary to define clearly the articles or materials required. Where but one type, grade, or class, etc. is provided, care should be exercised to place detail requirements under this section rather than under Section IV. The following, when applicable, should be included, the statements under each heading being contained in a separate subparagraph, properly designated: Physical Requirements; Chemical Requirements; Treatment; Finish; Plans; Tolerances; Spare Parts not listed in Section IV.

VI. METHOD OF INSPECTION, TESTS, ETC.

"In this section should be stated the tests to which the articles or materials are to be subjected in order to determine whether they conform to the requirements of the specification. This section should also include such descriptions of tests and methods of analysis as may be necessary to insure that they will be properly conducted, and other information, such as location of test specimens, method of sampling for chemical analysis, etc.

"When an umpire method of analysis is specified, either in the form of a detailed description or by reference to

some accepted standard method, it should be placed at the end of this section and be plainly captioned Umpire Method of Analysis.

VII. PACKING AND MARKING.

"Ordinarily, instructions regarding packing and marking do not form a part of the master specifications promulgated by the Federal Specification Board. Instances will arise, however, where marking for identification, or certification and special methods of packing to insure against damage in shipment, etc. should properly be included. Where packing or marking, or both, are included in the specification, detailed instructions therefor should appear in this section.

VIII NOTES.

"This section should be restricted to informative matter only, and should contain all necessary information of a general or explanatory nature, which is not properly a part of the preceding sections. For example, when it is desirable to state the use for which the material or article is suitable, such statement should appear in this section. It is appropriate to make reference here to other specifications covering other types, grades, classes, etc., of the same or similar material or article. Citations to specifications followed without change of technical requirements or with slight deviations, should appear here."[1]

1. Reference #7 - page 233-235

One of the weaknesses that seemed very noticeable to me in my interviews with purchasing agents and others was the lack of checking up on materials received. There are some plants who apparently make no effort to even count or weigh the materials received in their receiving room, simply signing for whatever is listed on the shipping slip or on the invoice. Some concerns spend a great deal of time and money on counting and weighing every least little particle of material received but entirely overlook the matter of determining whether or not they got what they ordered. As, for example, a certain organization consumes a considerable amount of sulphur which is found on the market in a number of different grades. No attempt is made to determine whether or not the sulphur received is that specified or whether it is very inferior. It so happens that every once in a while this concern has a run of output which is decidedly inferior due entirely to their failure to inspect the material which is submitted. Another concern with which the writer is familiar paid very little attention to their molding sand with the result that poor sand was received and used resulting in porous and rough castings. This roughness of the castings increased the machining cost in some operations 100 per cent while the increased porosity of the output resulted in a 200 per cent increase in defective parts.

There are several kinds of inspections which should be carried on regularly. It is many times advantageous, especially where materials are being bought on long term contracts, to actually inspect them while being manufactured in the seller's own plant. It is probable that the actual results obtained from such an inspection will be no better than from an inspection in your own plant, but the very fact that the purchasing agent is on his job and doing what he can to assure his concern of receiving the right product results in the seller taking more pains than he otherwise might. Then again, after the material is received the purchasing department should inspect materials for weight, number of units, size, shape, waste, and so forth. I have already mentioned the need for requiring rigid enforcement of size under the heading of quality.

Many times the waste from machining such as the chips of shavings in the machine department will tell a very interesting story about the heat resisting qualities of the material being used. Where a plant is not large enough to justify the employment of its own chemist it is a simple matter and a relatively inexpensive one to employ a research chemist to do such testing for heat values, chemical content, rust resistance, and so forth as will be necessary. Other concerns may be employed to test the materials for stress, shear, torque and so forth--the physical elements which

determine the fitness or unfitness of many materials. Then again, there are such products as rubber which must be inspected not only at time of receipt but also at time of use. This is especially true where rubber is in a crude or semi-crude state and where atmospheric conditions may have affected its utility very greatly. All these inspections from the time of placing the order with the manufacturer until the goods are put into process in the buyer's own plant should be constantly in his mind and under his control. Without them he does not control his materials as he should.

In closing I would like to emphasize the importance of the buyer knowing not only the processes, products, and uses of those products consumed in his own concern, but he should also know the sources of supply and the processes of manufacture of all articles which he is buying. If he can intelligently talk about the product he wants and knows what must be done to produce it he can judge fairly accurately the justice or injustice of the price demanded for it. Moreover, this knowledge will also enable him to know how much time it should take to manufacture and deliver the article, which is very much to his advantage when he is attempting to set delivery dates or to speed up delivery from the manufacturer. Moreover, the knowledge of the material, that is what it is made from, how it is made, and for what it is used, is absolutely essential if he is to recognize a

satisfactory substitute which may be placed upon the market at any time. Without this knowledge he can not recognize such new products with any degree of accuracy and it is his job to find satisfactory substitute material as well as to buy the materials needed at the present time.

CHAPTER V

OFFICE PROCEDURE

We have been discussing the question "What shall I buy?" The next question that comes to mind is "How shall I buy it?" To answer this question we must consider the details of the order. Before doing this, however, let us pay attention to the procedure of the office. There are certain definite steps to be taken such as the issuing of requisitions, the requests for quotations, the awarding of the contract, the preparation of the order, the checking of the receipts, the checking and paying of invoices, and the accounting for the material received.

The first document involved in the problem of buying is the requisition or order to buy. This is generally in the form of a request from a store-keeper or shop foreman asking the buyer to get certain articles. Its form varies greatly depending upon the system used. I am assuming in this discussion that Stores are under the control of the purchasing agent. It is my belief that this is necessary for several reasons. In the first place unless the buyer can control to some degree the kind of goods carried in stock and the quantity of each, the savings he makes by careful selection of the articles may easily be eaten up by the overhead charges of excessive inventory. In the second place he must have control of receipts if he is to be fully acquainted with the

business methods and reliability of the concerns he buys from. Unless he has this control he will not be in as good a position to watch the relation between promised and actual delivery either of dates or quantity. Then there is the problem of inspection. As has been pointed out already this involves inspection at time of receiving the merchandise, and the inspection at time of issue depending upon the article. Another factor is control of waste. Waste may be due to spoilage from method of storing, from hidden defects not discovered until machining, or from poor workmanship. Each of these reasons is important and the purchasing agent because of contract with the shop and at the same time with the financial problems of the company is in a most strategic position to evaluate the importance of each class of waste. Disposal of waste is not in many cases given the attention it should receive. It is of real value to the buyer to be in a position not only to know the causes of waste but to dispose of it to the best advantage.

Assuming then, that the buyer has control of stores the form of requisition on the following page is submitted as one possible form. Note that it is divided in two parts the upper part being filled out by the stores clerk. Under "article" he will fill in a sufficiently complete name to identify the article. For example if he wanted some reducing elbows, the word elbow would not suffice. He should specify

DIVISION MANUFACTURING CO.

PURCHASING ORDER REQUISITION No. ____

Date ____

To Purchasing Department:

Please secure the following material for department ____ Signed by ____

Article	Specification Data	Quantity Wanted	Date Wanted	Quantity on Hand	Remarks
(1)					
(2)					
(3)					
(4)					
(5)					
(6)					

PURCHASING DEPARTMENT RECORD

LAST ORDER			Maximum Stock To Be Carried	Approved	Quantity Ordered	From	Purchasing Order Number	Delivery Date
Date	Quantity	Bought From						
(1)								
(2)								
(3)								
(4)								
(5)								
(6)								

"$1\frac{1}{4}$" x 1" reducing elbows." Then in the specification data column place the number referring to the proper specification as established by the company and listed in the "Specifications Record". The next two columns need no explanation. The "No. of Units on Hand" column is important. A check must be made by the purchasing department to be sure the quantity on hand plus the amount to be ordered do not exceed the quantity set as a maximum to be carried unless an extra heavy demand is foreseen and explained in the last column "Remarks". Even then there is need for investigation before any excessive quantity is ordered. In the second half of the requisition the purchasing department tabulates vital facts, and submits the requisition to the agent for approval.

Requests for quotations are then sent out. Carbons of the requests may be attached to the requisition or a record of the requests sent and replies received may be tabulated on the back. The rest of the spaces are of course filled in when the order is placed. This form of requisition, it will be noted, permits several articles to be ordered on one form. The numbers in parentheses at the left of page in the requisition half are duplicated in the lower half making it possible to identify the article and its disposal at a glance.

This form of requisition is suitable for the ordering of common standard supplies such as are carried in stock at

all times. In the event, however, that a customer places an order for goods with special fittings such as demanding nickel plated oil cups, valves, etc. instead of the usual brass ones, or demand that pulleys be of special size this form of requisition is hardly satisfactory. In the first place it is desirable to have one form of requisition for stock articles and another for special articles. The difference in form immediately calls attention to the fact that something is wanted that is out of the ordinary and therefore requires special treatment. It may be that foreman A wishes an article that is special to him but is common to other departments. Not knowing that this is carried in stock, he has used a special requisition form. The first thing the purchasing department should do upon receiving a special form is to find out the why of the special requirement if it is special or to inform foreman A that the article is stocked. If after investigation it is found that the article really is special and really needed to meet the customer's demand, it should receive extra consideration and follow-up to be sure that the goods arrive on time. Then again it is always necessary to order plant equipment of one kind or another and here is the need of special specifications to be stated by the party who is to use the equipment and not by the purchasing agent.

The form of requisition on the following page is adapted to the requisitioning of all material not carried in stock.

DIVISION MANUFACTINRING CO.

SPECIAL PURCHASE REQUISITION No. S-______

Date ______________

To Purchasing Department:

Please secure the following special material for

department ______________ Signed By __________________

ARTICLE

SPECIFICATION

Article	Specification Data	Quantity Wanted	Date Wanted	Quantity on Hand	Remarks

Note that while the requisition number for stock orders uses figures only, special requisitions combine figures and the letter "S". This letter used as part of the reference number serves to distinguish requests for quotation, replies from bidders, and purchase orders which is to be desired.

It will be noted that in the first of these requisition forms there is a column provided for specification data. In practically every case if specifications have been prepared for all the products and parts of products produced by the plant it will be possible to fill in this column with the specification number. This would refer to the specification book and from that the purchasing department will get the data necessary to order the proper article. In the case of the requisition for special material it will be noted that there is a space provided for written specifications. In some cases all that will be necessary will be to give the specification number and then note any variations from the standard specification provided. In other cases a very detailed statement must be made.

It can readily be seen that special articles such as would be ordered on the special purchase requisition form will vary more from standard than articles ordered on the other form. It might even be made a rule that any article varying in the slightest from the established standard for which a specification has been provided must be ordered on the special purchase requisition form. The use of this form has for one of its chief purposes the calling particular

attention to the fact that an article other than a standard one is being ordered. Too much attention to this point cannot be given for the natural tendency of the engineering, sales, and production forces will be to order materials which are special rather than to use standard articles. Their motive in so doing will be perfectly innocent, their enthusiasm and personal desires will often cause them to overlook the fact that standardized material is necessary if the plant is to operate at the lowest possible material cost.

The next step in the office procedure is to have the request for quotation form prepared and sent to those concerns which the agent decides are best fitted to supply the desired material. It is obvious that the number of these requests sent out will vary with the article desired. It may be, especially in the case of requisitions for stock purposes, that it will be necessary to recombine the articles of the requistion into groups suitable to the different firms to whom requests for quotations are sent.

There is some question as to how best a record may be kept for requests of quotations sent. One method suggested has been that the articles be listed on the reverse side of the requisition with considerable space between. It will then be possible to make a record of the firms to whom requests for quotations have been sent for that particular article.

Naturally, when the request for quotation reply is received by simply checking off the name of that concern on the back of the requisition it is a simple matter to determine just how many quotations are still to be received. In regards to the suggested form, in the request for quotation appearing on the next page one or two facts are of particular importance. It is very desirable to have a very plain statement appearing in a conspicuous place that this is not an order for merchandise. The reason for this is that purchasing department forms in general use are so varied that it is possible sometimes for a concern receiving orders and requests for quotations to get the two confused. In addition as a matter of identification it is important that the purchasing department place their requisition number on every request sent out and request that the reply refer to this requisition number.

The next thing of particular importance is that all the bidding concerns be asked to base their price on some particular point in order that a truly comparative price may be obtained. It is perfectly obvious that a price f.o.b. Boston is really a lower price than the same money price quoted on these goods, let us say, f.o.b. New York.

The body of this request for quotation form is very simple and needs no explanation. The writer has seen forms which provide columns for unit price, catalogue price, trade discount, and so forth, but he cannot see the value of these items. It is up to the concern who wished to receive the

Request for
Quotation

DIVISION MANUFACTURING CO.

BOSTON, MASS.

NOT AN ORDER !

______________ 193

To ______________
____
____

Our Requisition No. ________

Gentlemen:

Please quote us your lowest price on the following material. Delivery must be made at our plant not later than ____________. Base your price on F.O.B. Boston.

Quantity	Unit	Article	Description

A purchase order accepting your quotation on all or part of the above material will cover the following conditions:

1 The acceptance of our order includes acceptance of all terms, prices, delivery, specifications, and conditions stated therein.

2. The condition of order will not be changed by any verbal understanding or agreement.

3. All packages must bear our order number and contain an itemized list of contents.

4 Each shipment must be covered by a separate invoice. Invoice and shipping receipts must bear our order number and must be mailed on day of shipping.

5. The right to cancel all or part of the order is reserved if the terms of the order are violated in any way.

order to quote prices and there is no need for the purchasing department to concern itself with the other man's business in this respect. The printed matter at the bottom of the form is submitted not as the best that might be used because cases alter the need but is simply there as an example of some of the terms which are valuable to the bidder to know when he is quoting prices.

Some concerns prepare carbon copies of the request for quotations, the carbon copy being so arranged that it may be used by the bidder as a reply to the original or request. In other words, instead of the word "to" and the name of the bidder the duplicate form would read "from" and the name of the bidder. Then the written material would read "we quote you" and so forth while the material at the bottom of the page would be an agreement of the acceptance of the terms enumerated on the original. This system has its good points, but it also has its weaknesses one of which is that many times printed matter on correspondence between two concerns is not studied as carefully by either as it should be. Whether or not this is an important factor is for the individual preparing the system to determine. The writer from his experience in buying material is in favor of leaving it to the bidder to submit his quotation in whatever form he may desire. I believe this because I have found that many times helpful suggestions and reasons for variation

in prices which would not have appeared on printed forms have been contained in quotations written on the bidder's own form.

Having received the quotations from those concerns who have been asked to bid, the next step is, of course, to issue the order to that concern which offers the best terms considering the four elements appropriateness, utility, service, and price. The form of purchase order appearing on the next page is submitted as a possible purchase order form although here again the line of business will determine the best form to be used. You will notice that the references here are three in number consisting of the purchase order, the requisition, and the bidder's reference numbers. With the large number of quotations and purchase orders that are constantly moving in and out of the purchase department the strict insistance upon the use of all reference numbers which will simplify identification is important. There is one very important thing about the purchase order which must not be overlooked and that is to fill in the blanks after "terms", "f.o.b.", "ship via", and the "date of delivery".

The shipping route must be determined by one of two things, either the element of cost or the element of time. The writer had occasion three or four years ago to get a quotation of freight rates for a shipment from Brockton, Massachusetts to a town twenty-five miles beyond Chicago.

DIVISION MANUFACTURING CO.

BOSTON, MASS.

PURCHASE ORDER

To ______________
____
____

______________ 193

Our Purchase Order No. ______
Our Requisition No. ______
Your Reference ______

Gentlemen:

Please furnish us with the following material in accordance with your quotation of ______________

Terms ______________ F.O.B. ______________ Ship via ______________

To arrive in Boston on or before ______________ 193

Quantity	Unit	Article	Description	List Price Per Unit	Trade Discount	Net Unit Price	Total Net Price
			Less Cash Discount of				

This order is placed subject to the following conditions:

1. The acceptance of our order includes acceptance of all terms, prices, delivery, specifications, and conditions stated therein.

2. The condition of order will not be changed by any verbal understanding or agreement.

3. All packages must bear our order number and contain an itemized list of contents.

4. Each shipment must be covered by a separate invoice. Invoice and shipping receipts must bear our order number and must be mailed on day of shipping.

5. The right to cancel all or part of the order is reserved if the terms of the order are violated in any way.

This shipment was a carload lot of finished material light in weight and of considerable value which of course made the freight rates rather high. There were two methods of shipping, one through what is known as the Albany Gateway and one by the St. Albans route. At that time the difference in the freight bill was $148. Shipment by the Albany Gateway would have reduced the time by nearly two weeks. Now suppose a shipper sending material from Chicago to Boston in quoting a price f.o.b. Chicago planned to ship the quickest way. You can see what a difference it would mean to the buying concern. Also the price quoted would not be comparable probably to the quotation of a concern planning to ship by water and rail through St. Albans. It is very important, therefore, that the request for quotation should contain shipping instructions. If because of later developments it is necessary to speed up shipment this can be noted on the purchase order form. Moreover, if instructions have been given the concern to ship by the cheaper route and in order to effect delivery before the date said they ship by the more expensive route, if the request for quotation, the quotation and the purchase order are in agreement they will have to stand the difference between the two freight charges. If the item of freight is watched carefully much saving can be effected.

There is no question but that considerable time could well be spent upon the other forms which are necessary to

proper control of stores and purchasing work. These, however, are of greater importance from the standpoint of administration and the requirements of other department than will justify us devoting time to them in this thesis. It naturally must be assumed that if the purchasing agent is in charge of stores he will be primarily interested in the shop requisitions, receiving records, defective parts records, and so forth, but there are others who are also vitally concerned with the information gathered from them. Since this is a discussion of the purchasing department and not a paper in management or system building we will not attempt to compare or discuss the other forms. It might be said, however, that the purchasing department, especially as far as the forms submitted here are concerned, should so far as possible use the $8\frac{1}{2}$ by 11 size. There is nothing more awkward than attempting to keep papers of several sizes clipped together and arranged neatly in files. If the purchase requisitions, requests for quotations, purchase orders, and specifications are kept on the same size it is evident that files will be neater and therefore more efficient than would otherwise be the case.

Mention has already been made of how files of catalogues should be maintained. It is, of course, necessary to remember that throughout the process of purchasing there will be requisitions and orders in various stages of completion. In

fact, we might say that there are at least four files for requisitions received but not O.K.'ed by the purchasing agent. Then there is the file of requisitions which have been O.K.'ed but are waiting for quotations. Then we have the requisitions combined with copies of the purchase orders which have been issued but which have not yet been delivered. We will also find a file of orders to which will undoubtedly be attached receiving room records reporting partial deliveries and even in some cases completed delivery but which have not as yet been checked for price or count of material. In some instances invoices will not have been received for the merchandise but it is always interesting to note that invariably, no matter how slow the concern may be in delivering merchandise, it almost always succeeds in getting its bill to the customer before the merchandise arrives. We would next find the file of orders which have been checked and possibly forwarded to the accounting department for payment. When notice is received that these orders have been paid, they should be deposited in their final resting place, the paid order file. Many of these files will be simply baskets or tickler systems depending upon the number of orders generally found in them. Care must be taken not to lose sight of any order or to allow it to be buried in a mass of other material.

The matter of checking the order before payment is of importance. In some organizations a regular form is attached

to the order on which provision is made for verification of certain facts such as the quantity received, approval of the quality, the check on the price billed as compared to the price quoted, the verification of all extensions and additions on the invoice, the checking of the terms, and so forth. At other times it is not necessary that a separate form be attached but a rubber stamp may be used and the data filled in on the purchase order itself.

Two methods seem to be in practice concerning the paid order file. The first is for a cost department form to be filled out containing the quantity and price paid for each article on the order, this form to be sent to the cost department to be used in costing merchandise and the original order filed in the purchasing department for their use only. The other method is to allow the cost department to use constantly the paid order file. The writer has seen both methods in practice and feels that the latter is really the better in concerns where there is a fairly large amount of special manufacturing. In such a concern the cost men are many times forced to give consideration to the special materials used as shown by drawings, conference with the shop force, and engineers and are unable to gather their information simply from the cost department forms which might be sent to them by the purchasing department.

One of the most important records from the standpoint of the purchasing agent is the specification book. This can

most readily be set up in the form of a loose leaf volume in which is contained specifications for the various articles which are stocked by the particular business. These specifications may be arranged by class, department of consumption, or alphabetically. The first method, which probably is most suitable in the majority of instances would provide main classifications such as castings, finished parts, fittings, raw stock, and so forth. Each of these divisions could be further subdivided, as for example under the raw stock we could have iron bars, steel billets, shafting, brass stock, sheets, and so forth. The second arrangement of specifications would be to divide the book according to the department and in each section put the specifications of those raw materials used by that department. This would be practical only in a concern where the product starting in a raw state was put through the plant by process each one using entirely different materials. Whereas the first method mentioned is more adaptable to a machine shop the second might be used in a pulp paper mill producing only one product of paper. The last named method, of course, could be used in almost any factory but might prove somewhat cumbersome in a case where there were an extremely large number of articles.

The chief difficulty which will confront the purchasing agent in the handling of specifications will be in keeping

the specification book up to date. In practice it is a simple thing to prepare specifications for a product at any given time. It must be remembered, however, that any energetic, successful concern will be constantly improving their product and many times improvement will be effected by changing the material used. Particular attention must be paid to seeing that the engineering department make no changes in production specifications without changing the materials specification record in the purchasing department. Moreover, at some particular period in the year it should become the regular duty of the managers of various departments to carefully consider each of the specifications as listed making such revisions as are considered advisable.

The work of the purchasing department may be divided, in places where the purchasing agent cannot handle it all himself, in one of two ways, either by materials or by functions performed. In some cases one person may be assigned to purchasing semi-machined parts while another man devotes his time to the buying of raw material and small fittings and a third interests himself primarily in purchasing new equipment. This division of labor in many cases will not prove as satisfactory as a division by functions. If work is divided on this basis the man in charge of statistics would devote his entire time to collecting data and passing on to the other members of the department information of value to them. He should be first of all an economist.

The second function, that of buying, would be delegated to one of two men who, having a knowledge of the market, devoted himself to a study of the individual concerns from whom materials are bought or may be bought to know their limitations as well as their ability to perform in a manner satisfactory to the buying concern. This person probably also having contact with the salesmen will undoubtedly be the man who will establish direct contact with the concerns in placing orders. The third section of the work will be that of the follow up which will see to it that deliveries are made promptly, that the goods are in the proper amount and of satisfactory quality, and disposed of upon arrival at the plant.

CHAPTER VI

THE ORDER

There are several important problems which are met in the preparation of the order to which special attention must be given. Too many times the purchasing agent considers his duty performed when he has chosen the article which is suitable to the work being done in his plant and when he has gone through the work being done in his plant and when he has gone through the routine of sending an order to some particular concern. There apparently is not enough appreciation in practice of the necessary detail and careful study of the terms of the order nor is sufficient attention paid to seeing to it that the terms written become the terms performed. Considerable savings in many cases could be made, for instance, if the purchasing agent would study more carefully the size of the order he places. It is, of course, very nice to be able to buy an article 10% below market price when the only thing involved is ordering a larger supply than is really needed. On the other hand, before the order for the large quantity is placed a careful study should be made of the cost of carrying the large quantity from the standpoint of the cost of stockroom space, the possible loss from deterioration, cost of the added working capital required for the enlarged inventory, and also the danger of loss through a drop in market price. All these elements are of real importance

and any one of them may, under given circumstances, absorb any gain which might occur from the apparent saving effected through large quantity purchasing.

This theory may sound as though the writer was discrediting the theory of large quantity buying. In a way this is true. His experience in purchasing plus the information gained from purchasing agents during the writing of this thesis leads him to believe that so much emphasis on large scale buying in textbooks, magazine articles, and so forth have caused the purchasing agents of many modern and small-sized plants to be induced to waste money where they are supposed to be saving it. Before large scale buying can be successful, and by large scale buying the writer now means buying in quantities which are large for the particular business concern, it will be necessary to give considerable attention to the problem of market supply and stability of price. It is true that in many cases through careful planning on the part of a department head and the buyer working together savings may be effected.

The writer draws from his own experience as an example of this. The office manager of a plant found that he was constantly having to place an order through the purchasing agent for the printing of some one of the many forms which were used in the office, the plant, and on the road by salesmen. After studying the question of the amount of each form needed for a given period a schedule was worked out whereby at certain intervals certain forms were restocked even though the

supply of all of them had not been exhausted. It was found that this permitted the concern doing the printing to set the type for several forms at one time, and then because they were printed on exactly the same paper and because the same number of each was required it was possible to put them into one printing frame and run them at one time. In other words, the two elements of printing cost, "make ready" and "running", for several forms were reduced to the cost of one. To be more explicit let us assume that forms A, B, C, D, E, and F were used in about the same quantity in a year but not always in a month. Although of different sizes these six forms could be cut from a 17 x 22" standard sheet with practically no waste. Assuming that about 50,000 of each was used in a year the order was first placed for 25000 of each. At the end of five months forms B and C were practically exhausted. Instead of simply ordering a new supply of these, a supply of all six was ordered the saving in labor offsetting the slightly added expense of carrying the excess stock for four or five weeks until needed.

This is however not what is ordinarily considered large scale buying, but it is a type of buying which is very practical and economical. Too much study cannot be placed upon the size of the order to be placed. It would seem, however, as though enough has been said on this question to make unnecessary any more discussion of a matter which can be

decided only from the careful consideration of a special problem which involves many things other than the work of the purchasing department.

The next matter which must be given special attention on the purchase order is that of discounts. Discounts, of course, are of two kinds, namely trade and cash. A trade discount is merely a means of stating the price in such a way as to make possible several prices on the same article or to make unnecessary the reprinting of price lists, catalogues, and so forth every time prices change. The question of cash discounts, however, is a bird of another feather. Some agents have operated on the basis that the bigger the discount the lower the price. This has brought about a situation somewhat similar to that found in retail buying. In the retail field certain store managers were of the opinion that by driving their buyers to securing the largest possible discount they obtained goods at a lower price and emphasized this to such an extent that gradually buyers began to vie with each other to see how large discounts they could get.

The writer worked for a short time with a concern which manufactured an article of clothing to be sold to haberdashers, department stores, and so forth, and a cash discount was allowed of 6% for payment in ten days, net forty. In other words, this concern was allowing 6% discount to the man who paid his bill thirty days earlier than the net date. At

this rate the firm was allowing 6% each thirty days or approximately 72% a year which is, of course, an absurdity. In order to get the trade of certain individuals it was necessary for salesmen to mark up an article supposed to be sold for a dollar to a dollar and ten cents. In other words, the man who bought the article for a dollar and received a 2% discount was a good deal better off than the man who paid a dollar and ten cents for the same article and demanded 6% off for cash. A cash discount is practical and valuable only so long as it measures a fair return to the buyer for the service of paying promptly and so long as it is not exorbitant to the firm who would have to borrow money provided the bill was not paid with reasonable promptness. The table which follows is taken from Rindsfoos's book on Purchasing, and gives the net time, cash discount terms, and equivalent per cent per annum of the cash discount when taken.

Cash Discounts[1]

Net time	Cash discount	Equivalent per cent per annum
30 days..........	½ of 1 per cent, 10 days.	9
60 days..........	½ of 1 per cent, 10 days.	3 3/5
90 days..........	½ of 1 per cent, 10 days.	2 1/4
30 days..........	1 per cent, 10 days......	18
60 days..........	1 per cent, 10 days......	7 1/5
90 days..........	1 per cent, 10 days......	4 1/2

[1] Reference #9 - page 46.

Cash Discounts (con'd)

Net time	Cash discount	Equivalent per cent per annum
30 days...........	2 per cent, 10 days.....	36
60 days...........	2 per cent, 10 days.....	14 2/5
90 days...........	2 per cent, 10 days.....	9
30 days...........	3 per cent, 10 days.....	54
60 days...........	3 per cent, 10 days.....	21
90 days...........	3 per cent, 10 days.....	13 1/2
60 days...........	2 per cent, 30 days.....	24
90 days.....	2 per cent, 30 days.....	12

The following terms are taken from the same book and illustrate the range of discounts which are allowed:

Aluminium	No cash discount, n/30
Carpets	4/10, n/30
Iron castings	2/10, n/30
Iron pipe	No cash discount, n/30
Coal	No cash discount, n/20th of month following
Drafting room supplies	5/30, n/60
Hardware	2/10, n/30
Lumber	2/30, n/60
Steam packing	2/10, n/30
Iron and steel shapes	$\frac{1}{2}$/10, n/30
Machine tools	1/10, n/30

Rindsfoos has set forth the following rules governing the way cash discounts may be used. These rules are:

1."If the buyer's credit is good use this as a lever for a large cash discount or a long dating."

2. "If the seller's credit is poor insist on a large cash discount."

3. "Always arrange favorable terms but always make this the final concession which the buyer must make to get the order."[1]

In regard to this last rule bear in mind that if a large discount is insisted upon and the seller knows it will be demanded he will in all probability boost his price enough to protect himself. With due respect to Mr. Rindsfoos' ability and knowledge of purchasing the writer must take exception to this third rule. It might work once or twice but sooner or later experience would tell the seller that this was to be demanded of him and he would simply govenn himself accordingly.

The following factors must be taken into consideration in determining the terms which are reasonable and are to be demanded. First is the marketing period, in other words the length of time the article is in process of manufacture and distribution. Two extreme examples of this are first the output of a local bakery where things are manufactured and sold and paid for within a period of 48 hours. Here the terms necessary to be allowed the baker only need be a reasonable period for him to turn his stock of raw material. This situation is quite different from that found let us say in an industry manufacturing farm machinery where although the machinery may be manufactured in the summer of one year, distributed in the fall and winter and sold in the winter or spring it cannot be paid for because of the financial condition

[1] Reference #9 - page 50

of the buyer until the following fall when the crops have been harvested. Naturally it is to be expected that the terms for these two lines will be considerably different, that the cash discount of the latter concern will probably be larger, and the datings longer. This is also true of any other product which is a seasonal one.

Then again, the element of competition enters in. Many manufacturers find it more or less difficult to persuade middle men to act as agents for them unless they make considerable allowance for carrying middle man and also in part his customers. It is obvious that regardless of what the conditions of the market are the buyer must take into consideration his own company's financial condition in determining the terms which he shall demand. It may be advisable to demand longer datings or large discounts on material he buys in the spring of the year when liquid funds are low, stock of merchandise high, and the income from sales still in the future. On the other hand, six months later when stocks are low, liquid funds plentiful and perhaps idle it will be to his advantage to insist upon a low price in preference to a large discount or a long dating.

Datings are of several kinds. There is the ordinary dating such as 30, 60, or 90 days net. There is the advanced dating as for example material shipped and delivered in November is dated January 1st or later, and seasonal dating

such as fall, winter, spring, and so forth. Here, of course, we run into an indefinite date varying with the industry. This, perhaps, is not commonly found in industrial concerns it being a more common matter in the retail trade.

One of the most important items involved in awarding the contract and in making out the order is to make certain that the delivery terms are adequately provided for. There are a number of important points to be considered in regard to this question. Many times an emergency bonus or penalty clause is included in the contract, a bonus to be paid if the material is delivered before a certain date and a penalty if the goods are not delivered at a stipulated time. These types of clauses ordinarily provide a money consideration, often on a sliding scale basis, that is a certain percentage of the contract price to be deducted as a penalty if the delivery is one week late, a larger amount if it is two weeks late, and so forth. There is considerable disadvantage to using the bonus or penalty clause whenever it can be avoided. Either clause may in certain cases be directly responsible for the seller skimping some of the work in order to earn the bonus or to avoid the penalty. Often purchasing agents have found it necessary to use the bonus or penalty clause to protect them for their own negligence in not maintaining an adequate supply of material. There are, of course, instances where special orders from customers required in an emergency justify the use of the bonus or penalty. And again,

a breakdown in the purchasing agent's own plant certainly will many times justify a bonus and penalty clause in order that the work of the entire organization may not be disrupted for too great a period. The main point to be given consideration is whether or not the use of these provisions in a purchase order is absolutely necessary. If this is the case, the next important thing is to remember that if you are justified in imposing a penalty upon the seller he is justified in expecting a bonus provided he exceeds what might reasonably be considered reasonable performance. Too often a purchasing agent is inclined to believe that the fact that he wants an article at once is all that is necessary to justify demanding extra work and expense on the part of the seller. In other words, he feels that if it is necessary for the selling concern to pay men time and a half or double time for overtime work in order to meet his delivery date that it is their lookout and no concern of his. On the other hand, if you look at this from an economic viewpoint and remembering that in general such added expense is bound to be charged to us eventually, then it becomes clearer that the fair purchasing agent will be willing to gamble with the selling concern to the extent of offering a bonus for exceptional performance.

The next consideration is how the bonus and penalty shall be determined. This ought to be boiled down to a

problem of mathematics, for no bonus or penalty clause is justified unless a loss in money, or goodwill, or shop morale is incurred. If this be the case it is quite possible to measure with varying degrees of accuracy the monetary loss and this loss interpreted into actual loss per day. When this has been done we have something on which to base the amount of the bonus or penalty, and it would seem reasonable to assume that you can well afford to share with the seller any decrease or increase in this loss which can be laid to his door.

Then, too, delivery date can often be determined from whether or not the material desired is carried in stock or produced at the mill. Let us assume for a minute the conditions concerning materials which may be delivered either from stock or from factory direct. Of course if only a small quantity is desired it is obvious that there will be little saving in requesting delivery from the mill but if a fairly large amount is needed then there is often a considerable saving effected. We must not overlook the fact that in the cost of goods delivered from stock there is not only the cost of manufacture plus manufacturer's overhead but there is a transportation charge from factory to stores, the cost of storage and if a middle man is involved his cost of operation and profit. All these items naturally mount up rapidly. Therefore it is obvious that where merchandise can be ordered direct from the factory some of these items

can be eliminated. In the machine tool industry, for example although some of the concerns naturally are producing tools which are standard and which are for sale at regular machine tool supply houses and hardware stores there are a number of types of products such as cutters, grinders, and so forth which are more or less special in that they are not made in advance in any quantity as is the case with tools more commonly demanded such as wrenches, screw drivers, bolt cutters, and so forth. Therefore, rather than to order these tools from a jobber money often can be saved by placing the order with the manufacturer and allowing him to make these articles on your order in the natural routine of his business. No saving, however, will probably be effected unless this last point is possible, that is allowing the goods to be manufactured in the natural course of work for if you do not allow enough time for this and demand that your order be given special attention you automatically increase the cost to the manufacturer and therefore to yourself.

I have previously mentioned the importance of knowing the product you are buying, the materials it is made of, their accessibility, the processes to which they are submitted, and the cost of performing these processes. It would seem obvious that with such a knowledge the purchasing agent is in a position to force the seller to perform as nearly efficiently as far as the buyer's work is concerned as is possible. We may use as an illustration the case of

buying castings. If the purchasing agent does not know when he sees the order for the casting whether or not this may be machine molded or whether it must be hand molded, if he does not have a good knowledge of the type of cores required he cannot very well know whether or not the price being quoted him is justified nor can he tell whether the manufacturer is taking an unreasonable time to effect delivery. The more thorough the knowledge of the article being bought the more able the purchasing agent is to deal intelligently with the selling concern.

There are two things involved in delivery, first not to get the material into your plant too early, for if you do you have too large a stock of merchandise with resulting increase in cost of stores and so forth and crowded conditions in the stock rooms, and second to get the material there in ample time so that work in your own plant will not be delayed. In the majority of cases this problem is the more important and it will be profitable at this time to consider some of the means of securing prompt delivery. First and most important of all, the use of the word "rush" on purchase orders is of little if any value. Any purchasing agent who inquires of his sales manager will quickly realize that the word rush is abused by almost every buyer and it has reached the point where generally it is ignored almost entirely. If, however, it is felt desirable to use this word, do not stop there. Follow up letters should be

directed to the man in charge of this work at the seller's plant, personal telephone calls, and even personal visits may be necessary in order to secure the delivery that is desired. If the purchasing agent has been reasonable in his delivery demands in the past and is not one of these buyers who always is in a rush for whatever he orders it is quite likely that special attention as mentioned will secure special attention on the part of the seller. The main problem in securing rush delivery and prompt delivery is to play fair with the seller giving them as much time as possible on the majority of orders but when you need special attention insisting upon receiving it. The worst thing that can happen is to demand special attention and then not to see that you get it, for the next time that you demand special attention the seller, basing his opinion on your past performance, will be apt to promise without any intention of fulfilling his agreement. Too many concerns are in the habit of demanding deliveries which are unreasonable and then not enforcing the penalties which are supposed to have been imposed. It seems to be a common practice with many purchasing agents to state that if material is not delivered on or before the time specified in the contract the material may be refused at the option of the buyer. This is rather poor reasoning and unfortunately is a plan which is not workable in the majority of

cases. If the order for the material set delivery at approximately the time it was to be needed in the plant, the buyer not having that material will hardly have time enough to cancel an order, place it with another concern, and get the material in time to avoid disrupting his own organization. Therefore, rather than taking any chances he simply comments more or less caustically on the business methods of the seller, accepts the material, and pays the bill. I have heard of a purchasing agent who wanted the material of a certain concern as it had been found to be superior to that of any other concern. They had the habit, however, of not meeting delivery dates. Nothing he could do seemed to convince them that he was one purchasing agent who insisted upon this term of the order being fulfilled. He therefore placed an order with them for some material not used by the buyer as commonly as some of the seller's other products and which could be bought elsewhere in the market. He was very emphatic in stating the delivery terms and in drawing up the cancellation clause. He immediately proceeded to place an order for the same material with another concern. As delivery date approached he called the first concern on the telephone, wrote them letters, and did everything that could be reasonably expected of him to secure prompt delivery. The delivery date came and went but the goods had not been delivered. In the meantime the firm which had received the

duplicate order had fulfilled their agreement and delivered the material. The purchasing agent waited until he knew the first company was about ready to make delivery and then notified them that the order was cancelled. He had taken particular pains with the wording of his order and was able to show them that there was no legal recourse. The concern was very much upset and surprised at this treatment and the purchasing agent had no difficulty in convincing them that on all future orders delivery dates must be adhered to.

When there is danger of delivery not being effected in time it is often advisable to direct the seller to trace shipments. This can be done by sending a tracer to follow the process of the shipment from terminal to terminal and from railroad to railroad from point of shipment to point of delivery. Often this "trace and ship" term is written into the contract and is found very helpful especially in the case of shipments that go over several roads or for long distances. Not only can a tracer be used from the selling concern but a tracer can be demanded from the railroad and one of your own men can be assigned to following this shipment. Obviously, there will be cases where the cost of tracing can be paid for by the purchasing department as an additional charge and be entirely justified.

As another point in effecting delivery let me once again state the importance of wherever possible putting the

f.o.b. point for each order at your plant or city. This places the burden on the selling concern to get the material to you and does not place upon you the additional expense of excessive freight charges simply because the manufacturer was unable to deliver the goods to the transportation company early enough to take advantage of differential rates.

Depending upon the material being ordered is the question of the inspection clauses to be printed on the forms and to be contained in supplementary statements attached to the order itself. Inspection should receive much more careful attention than it is usually afforded. Many times goods are considered satsifactory if the quantity and general appearance of the article meets with the terms of the order, but unfortunately quality is often far below the standard set. It is obvious that the only way to determine this discrepancy is to insist upon the right of inspection. Inspection may first be conducted in the plant of the manufacturer by a personal visit from the purchasing agent or a skilled mechanic from the buyer's concern. The privilege of inspection during manufacture often may be used as a check to insure prompt delivery especially in cases where there is urgent need for the article. Often times a request addressed to the manufacturer asking if shipment will be made promptly will receive an affirmative reply when, if inspection is made while the goods are in process, a knowledge of the

manufacturing stages will enable the inspector to realize that the business will not be completed ready for delivery at the stipulated time unless special attention is given to them. It then becomes a simple matter for him to show the manufacturer that he can not be put off with mere words and that something must be done to speed up production to be sure that delivery is made on time.

When the goods are received at the plant inspections should be made as previously outlined. The same difficulty exists here as in some other of the purchase terms, namely the failure of the buyer to insist upon specific performance. Too often very carefully and elaborately worded clauses concerning inspection are placed in purchase contracts and then nothing is ever done about them. The result naturally is that eventually sellers get careless and do not always send the goods which are up to the rigid specifications set.

Usually penalties for failure of goods to measure up to prescribed tests is for the goods to be returnable without charge. The unfortunate feature of this clause is that many times it is not possible to enforce the rule simply because the goods are so much in demand that it is felt better to accept the inferior quality than to send it back and wait longer for fresh materials. Often penalties can be based on price changes much more effectively. Sliding scales for these penalties can be put into the contracts in such a way that slight variations below standard will impose a slight reduction in price not injurious to the

seller, but more serious variations will absorb all his profit and even work him a serious loss. Penalties of this kind, especially for articles where sales competition is relatively keen, will soon convince a manufacturer that it doesn't pay to violate specifications. In the buyer's concern since the prime object of inspection is to assure the buyer that he is to receive satisfactory merchandise, no better type of penalty can be imposed.

Strange as it may seem quantities and units cause considerable trouble in writing orders. There are some materials which are bought by the pound, others by the unit and others by liquid measure. Still others are bought by either of two measures as for example bolts and nuts are bought usually by the hundred. Rivets, washers, and so forth are priced by hundred pounds while nuts bought separately are priced by hundred pounds or by unit. Then again such materials as angle iron, bar stock, and so forth, are ordered by size but priced by weight. It is of real importance that the unit used in the purchase order is in agreement with the unit specified on the requisition or if a different unit is necessary that it conform with trade practice.

CHAPTER VII

ECONOMICS IN PURCHASING

Up to this point we have been looking more at the general problem of purchasing than at the mechanics of purchasing. It will now pay us to devote particular attention to a few of the more fundamental factors involved in successful buying. Chief among these is the matter of economics. Earlier in the paper I spoke of the importance of economics to the purchasing agent and also of the need for technical knowledge but feel that while technical knowledge is valuable the amount of it and the question of whether it should be mechanical, electrical, chemical, or in some other phase of engineering or science depends so much upon the particular concern by whom the purchasing agent is employed that this naturally can be left without further discussion.

Knowledge of economics, however, is of vital importance to any buyer regardless of the type of industry which employs him and regardless of the size of his plant or of his department. No buyer for either a large or a small organization can be successful without both a theoretical and a practical knowledge of economics. Much has been written about this field of study which consists of interpreting the experiences of society and of individuals in the light of their effect upon those four factors: land, labor, capital, and manager. Nothing can happen in the modern age without having its

reaction upon one of those four phases of economic study. Without question whatever affects any of these four items automatically affects supply and demand of material and therefore affects price. Regardless of what the change may be if it affects the supply in that it reduces it or increases it, automatically it decreases or increases demand through the change in price. If on the other hand demand is changed, then the supply because of the change in price must be decreased or increased. Of course, some articles are affected more rapidly than others. Mr. Harriman in his book on purchasing makes the following statement: "In general, the wider the market the more general the use of the commodity, and the greater the ease with which the commodity can be sorted into standard grades (as is the case with wheat, cotton, and iron) the more accurately will competitive forces fix a definite price."[1]

We are often inclined to think of price as being the measure of an article's worth. However, the economist naturally places a somewhat different interpretation upon the term price than is generally found in common usage. The economist considers that price is really relative worth expressed in terms of another article. In other words, if the price of wheat falls 20% the economist may say that wheat is worth as much as before but that money is worth less.

1. Reference #2 - page 33.

Value to the economist is simply the measure of utility of an article. Utility in turn can be measured "by the amount which a person will give to procure an article or a service."[1] From the practical standpoint, then, we may say that utility is the measure of price, and we may consider again that the utility or worth of an article is expressible in terms of appropriateness, quality, and service. We thus get back to the original statement previously made that in determining what the purchasing agent will pay for an article we must consider these four elements: appropriateness, quality, service, and price in the order named. If we take these four factors, give each the individual attention it should receive, and then interpret it into a matter of price we can soon find an article which will give us the lowest possible true cost. "The real cost of an article then is the price of that article divided by the service it will render. If the service means miles then the unit cost is the initial price per unit divided by the total miles of service per unit. It is the buyer's business to determine if possible the cost as well as the price of an article."[2]

There is of course without question great need for a buyer to recognize the effect of world-wide happenings upon prices. Past history shows us very vividly that a war many hundreds of miles from our locality is bound to have its effect upon our daily lives. This becomes more true each

1. Reference #10 - page 124
2. Reference # 2 - page 32

year as distance is overcome and we become more dependent upon other nations for many things once used in luxuries now are required for the production of necessities. The effect of monopolies upon business is equally obvious to the thinking individual, and the purchasing agent must be wide awake to recognize monopolies in the infant stage in order that he may be prepared for whatever effects they may have on him as they grow. There are other factors which require a knowledge of economics to appreciate such as the market effect in governmental policies concerning governmental ownership, transportation, financing, marketing, taxation, insurance, tariffs, and export duties. Then too the purchasing agent should have a well grounded knowledge of economic geography in that he may appreciate more quickly the rapid changes which often take place because of new sources of supply. The attitude of other concerns toward our own from the standpoint of commercial policy must be watched. Trade associations and pools may attempt control of prices. It has been a practice many times in the past for a group of manufacturers to attempt to control competition by cutting prices or to withhold orders until they have forced the manufacturers of certain commodities to lower their price beyond reason. The following quotation will illustrate perhaps some of the dangers of such a practice. It is taken from the April 12, 1928 issue of Iron

Age and is the summary of an address before the New England Purchasing Agents Association.

"In the long run, buyer and seller alike will be adversely affected by any influence which undermines the stability of the other. The best assurance for the consistent prosperity and progress of both, and of American business as a whole, lies in active cooperation to foster constructive influences and stamp out those, such as price cutting, which are responsible for destructive competition that menaces the welfare of all concerned"- - - - - - - - - - -

"The Bell Telephone System was one of the first large organizations in the country to lift some of the emphasis from price and place it on those other factors where it belonged. Price remained important, but even more consideration was given to the twin elements of quality and service.

"The advantages of the shift quickly became so apparent that a number of other organizations fell in line. Their purchasing agents were lifted from their former positions as official hagglers, and were turned into purchasing engineers whose duties include the study of fundamental factors that control price movements and underlie the production of raw and semi-finished material."

(The results of price cutting are as follows: prices go so low as not to show a reasonable profit. In order to avoid loss, quality and service, suffer because of substitute material and inferior workmanship. Because of the

general let-down deliveries lag, the buyer does not receive what he pays for and as a result obtains no advantage over competitors for if the seller will cut the price for one he will cut it for another.)

"About a year ago it was reported that the producers of sheet steel were losing an average of over $8 a ton on every ton of sheet steel turned out in their plants. Think of it! There is an industry, well established, with heavy investments in plant and machinery, and supplying an essential commodity. Business conditions were generally good throughout the country. The market for sheet steel was expanding. Yet the sheet steel mills were not only unable to operate at a profit; they were forced to operate at a loss. Price cutting was almost wholly responsible for this condition.

"A large part of the product of the sheet steel manufacturers is used in automobiles. The automobile industry is very nearly dependent upon the sheet steel industry. It is almost impossible to conceive of an automobile without a steel body. If the sheet steel industry were forced out of existence, or if its efficiency were materially reduced, the automobile manufacturers would suffer irreparable injury.

"The automobile manufacturers, however, did not hesitate to take advantage of opportunities to obtain quotations below the cost of production. This attitude, coupled with the

weakness of the sheet people, resulted in after price demoralization that shook the stability of the entire sheet steel industry. Fortunately the automobile manufacturers appear to have realized the suicidal nature of their policy, and they have announced that they are willing to pay a fair price if they can be assured that the first price quoted will be the last."[1]

Perhaps there is no subject with which the purchasing agent should concern himself more than that of the business cycle. The business cycle has been before the minds of students for a long time, but it is still an unsolved mystery. The term business cycle is used to describe the ebb and flow of business activities for apparently there are four distinct phases through which business passes at irregular intervals. These four may be called the period of prosperity, the period of liquidation, the period of depression, and the period of revival. Most writers seem to agree that there are two classes of causes for these so-called cycles. The first is due to developments in our industrial system such as changes in technique, in organization, in markets, and in demand. The second is the so-called rhythm of business.

"The second is 'the rhythm of business activity', or the economic cycle. A depression characterized by conservatism in business and financial activity, gradually leads to an improvement in conditions; as business expands a spirit

1. Reference #13 - page 1005

of optimism arises, and stimulates further expansion; the latter reacts upon the feeling of optimism and causes it to assume a tone of overconfidence which leads to 'flush times' and feverish activity; sooner or later business overshoots the mark, losses occur, and perhaps a crisis, contraction is necessary, and a depression again appears. The cycle is a closed one; it has no logical beginning and no consummation. From lean to fat to lean years it ever runs its varied round."[1]

There are four kinds of cycles, namely seasonal, cyclical, secular, and casual. The seasonal cycle is to be found in such industries as agriculture, lumbering, building, some types of mining, in other words where production is dependent upon the seasons of the year. A cyclical cycle is a period cycle not measurable in advance. It may vary from one to fifty years but during this period the four stages will have held sway. Then there is the secular cycle which is simply a smooth long-time trend with but few marked variations from it. The casual cycle is caused primarily by factors beyond the control of business individuals such as tariff changes, taxes, and so forth. We might wonder why business should apparently of necessity be forced to go through these periods of prosperity and depression and if we will stop to consider the complexity

[1] Reference #12 - page 48.

of modern life we can more easily see that equilibrium has easily destroyed.

"Embarrassing as the multiplicity of explanations may seem at this stage, it is an embarrassment which must be faced, because it arises from the complexity of the problem itself. Everyone who has had practical experience in business knows that business is affected by numberless factors physical, psychological, political, economic or social in origin; local, national or world-wide in scope; obvious or obscure in character and working; temporary or enduring in effect. And everyone who has studied economics realizes that business activity depends upon the smoothly coordinated functioning of many processes, the extraction or growing of raw materials; the fabricating, distributing, transporting and consuming of goods; the paying and spending of money incomes; the saving and investing of capital; the granting and cancelling of credits. Any of these factors or any of these processes can be made to yield a plausible theory of business cycles, provided some investigator can show that it is an independent source of recurrent fluctuations in the activity of trade. And that is what each of our theorists believes himself to have done with reference to the factor of his choice. Nor can we be sure in advance that any one of them is wrong."[1]

[1] Reference #12 - page 48.

Since men first began to think about this matter of business cycles we have had many theories advanced as to their causes. About 1880 W. S. Jevons became interested in an idea previously put forth that the business cycle was caused by sun spots which affected the weather. He studied the records of British commerce and found that the business cycle was about 10½ years while the sun spots cycle was practically the same. He was convinced that the business cycle could be measured by the sun spot cycle and later his son suggested practically the same solution with some modifications reducing the period, however, from 10½ to 3½ years. Another theory advanced by Professor Huntington was that health was a cause of economic conditions rather than an effect for he found that a death rate curve inverted bore certain relations to school attendance, bank clearance, wholesale prices, and so forth. Professor Sombart claimed that business cycles were due to the fact that industries could be divided into two kinds, those dependent upon organic materials and those dependent upon inorganiz materials. The various changes in these two types of industries created an unbalanced condition which produced the business cycle. It seems worth while that we quote at some length a summary of current theories of business cycles as set forth by Professor Mitchell.

"A Classification of Current Theories of Business Cycles"

"I. Theories which trace business cycles to *physical* processes

1. Three-and-a-half-year cycles of solar radiation produce similar cycles of crop yields, and so seven- or ten-year cycles of business activity. H. S. Jevons.
2. Eight-year periods in the conjunction of Venus produce similar cycles in mundane weather, crop yields, and business. Henry L. Moore.
3. Weather cycles affect health, health affects mental attitudes, and mental attitudes affect business. Ellsworth Huntington.

A theory intermediate between the groups stressing physical and institutional processes.

Industries which depend upon organic, and industries which depend upon inorganic materials have unlike rhythms. The resulting disturbances and restorations of balance produce business cycles. Werner Sombart.

II. Theories which trace business cycles to *emotional* processes.

1. 'Optomistic error and pessimistic error, when discovered, give birth to one another in an endless chain.' A. C. Pigou.

2. The fluctuations of birth rates and death rates are chiefly responsible for mass alternations of optimism and pessimism, and thus indirectly responsible for alternations of prosperity and depression. M. B. Hexter.

III. Theories which trace business cycles to institutional processes.

1. Cycles arise from the change of institutions.
    (1) Social progress is by nature jerky: changes in its pace and direction produce disturbances from time to time in the moving equilibrium of economic processes. Emanuel H. Vogel.
    (2) Innovations come in waves, and initiate periods of activity followed by crises and depressions. Joseph Schumpeter, Minnie T. England
2. Cycles arise from the functioning of existing institutions.
    (1) From the technical exigencies of money-making: Fluctuations in prospective profits cause fluctuations in business capitalization and confidence; the latter in turn give rise to new fluctuations in prospective profits. Thorstein Veblen, Jean Lescure.

The money economy leads to fluctuations in mercantile orders, manufacturing and the production

of raw materials which are progressively larger than the fluctuations in consumers' purchases, upon which all business depends, directly or indirectly, for its market. Henry S. Dennison, Lawrence K. Frank, Simon S. Kuznets.

The reason why the aforesaid fluctuations grow wide as one passes from consumer demand toward the production of raw materials lies in the competitive illusion to which our buiness system gives rise. Thomas W. Mitchell.

(2) From lack of equilibrium in the processes of disbursing and spending incomes and of producing values:

Incomes paid to wage earners lag behind changes in the money value of goods produced, thus making consumers' demand alternately larger and smaller than current supply. R. E. May.

Inequalities in the rates at which prices rise and fall cause consumers' incomes to lag behind the output of consumers' goods in prosperity, and to exceed that output in depression. Emil Lederer.

Incomes disbursed by business enterprises to individuals are alternately less and more than the full value of the goods produced

for sale; the fluctuations thus initiated are enhanced by the savings of individuals. Waddill Catchings, William T. Foster and Hudson B. Hastings.

Prosperity requires an increase of liquid capital, which can be provided only out of funds which must be spent for consumers' goods if prosperity is to continue. Recovery comes because depression checks the growth of liquid capital.
P. W. Martin.

Consumers' incomes can be made to exceed the value output of consumers' goods only by expansion of capital equipment, financed by expansion of bank credit. But this condition, which characterizes prosperity, works its own undoing. A. B. Adams.

(3) From lack of equilibrium in the process of producing and consuming goods in general:

Waves of general over-production result from 'the well-nigh universal fact of industrial competition.' Sir William H. Beveridge.

The uncertainty involved in all business planning leads to alternate over- and under-production of goods. Charles O. Hardy.

Good trade leads to rapid increase in industrial equipment and later in output, and finally to

a decline in the marginal demand prices for consumers' goods. A depression follows in which the growth of industrial equipment and output is checked. The marginal demand prices for consumers' goods finally rise again, and a new period of activity begins. Albert Aftalion, Mentor Bouniatian.

(4) From lack of equilibrium in the processes of consuming, saving, and investing capital in new construction:

In prosperity the demand for capital exceeds current savings; the resulting scarcity of capital brings on a crisis. In depression, investment falls below current savings; free capital accumulates until investing becomes aggressive once more and starts a new period of activity. Michel Tugan-Baranovski.

Large incomes, which grow rapidly in prosperity, lead to over-saving and over-investment in new plants, so that supply exceeds current demand. Depression follows, in which the large incomes are reduced, and over-saving ceases, so that consumption catches up with output and starts a revival. John A. Hobson.

Crises are caused by over-production of industrial equipment and concomitant under-production of the goods necessary to use that equipment. Arthur Spiethoff.

Relatively slight changes in demand for consumers' goods and in costs of construction cause far more violent changes in the volume of construction work: the latter changes react to heighten and propagate changes in the demand for consumers' goods. George H. Hull.

Over-commitments to business extensions of all sorts involve additions to purchasing power not counterbalanced by increased production. Prices rise until they reach a level at which men see danger in adding to their stocks. Then purchasing contracts and a crisis comes. Malcom C. Rorty.

(5) From the processes of banking:

Banks increase the purchasing power of business men, when prospects are favorable, by lending credit; the activity thus stimulated grows cumulatively until the banks are forced to restrict advances. Then comes a crisis and depression, during which idle funds accumulate

in the banks and enable them to start a new movement of expansion. Alvin H. Hansen

When banks have large reserves they reduce discount rates, and thus encourage borrowing and business expansion, which grows cumulatively until the banks find that larger cash requirements are impairing their reserves. Then banks raise discount rates, restrict loans and thus reduce business activity. Funds again accumulate in the banks because cash requirements are now smaller, and the cycle starts afresh. R. G. Hawtrey."[1]

Having studied the theories of what causes business cycles we may readily conclude that there is still considerable to be learned about them. Whether or not we shall adopt any one of them is rather questionable, nor is it necessary for our practical purposes. It is simply important to remember that cycles exist and will continue to exist just so long as equilibrium of population, technique, and demand is not maintained. If we will bear in mind that business cycles come into being as soon as modern society becomes an important factor in a nation's life, we can see that business cycles must be a result of modern social structure. It is quite unlikely that the time is near when absolute equilibrium will be reached. Therefore, it is for us to

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1. Reference #12 - page 50

accept the inevitable, use the facts and figures we have available, and measure as far as possible the effect of business cycles upon us. If we will keep in mind the fact that the cycle cannot be measured like the r.p.m. of a machine we will have made a good start. We can, however, draw a comparison between r.p.m.'s and business cycles. It might be said that we can find the r.p.m. required by measuring the energy to be applied and the resistance to be overcome. In other words, knowing the resistance and the desired r.p.m. we can determine the necessary energy to be applied. In the business cycle we find that the length or rapidity of movement is due to the speed of production and the rate of consumption. Unfortunately, however, neither the speed of production nor rate of consumption can be definitely measured far in advance because of the uncertain elements involved. Therefore, since the cycles cannot be controlled, they must be watched and measured and the accuracy with which they are measured will be reflected in the buyer's work. Bearing in mind that business cycles affect all phases of business such as sales output, wages, purchases, distribution, and so forth the following quotation from Mr. Babson is of interest.

> "One cannot do better, when studying this subject, than to refer to Hon. Theodore E. Burton's book entitled "Crises and Depressions," in which, among other things, he states:-
>
> "'In the season of activity, which precedes a crisis, prices rise. This rise begins after the worst of the previous depression has

been reached. Attention has already been called to the fact that the rise in prices is unequal in different commodities. Iron and steel in their various forms, as well as other commodities.required for construction, and those which supply new demands of consumption, show the most striking increases. During a depression, prices of these commodities fall first and most notably. The prices of other commodities do not fall so much or so early. In the preceding season of expansion they do not rise so much, and, in their rise as well as in their fall, they show, for the most part, only a remote effect of the activity or inactivity of the time.

"'As is well known, it is the tendency of prices of iron and steel to reach and pass their maximum some time before the crises occurs, though if the crisis be precipitated by an unexpected failure, the interval will be short or the high prices may continue until the very outbreak of the crisis.

"'In the United States, prior to the crisis of September 18, 1873, a low price level appeared in almost all grades of iron and steel in January, 1871. This was followed by a rapid and almost unbroken rise, culminating in the months of October and November, 1872. A maximum price of rolled bar iron, $118.72 at Philadelphia, was reached in October, 1872. The price fell, with slight fluctuations, to $80.64 in September, 1873, the month of the crisis.

"'In the depression which followed the crisis of 1873, prices of a majority of the varieties of iron and steel fell to a minimum in the latter part of the year 1878, though steel rails and standard sections of iron rails fell to a minimum in the closing months of 1877. The month of November, 1878, may, however, be selected as the turning point. At that date No. 1 anthracite foundary pig iron had fallen to $16.50 per gross ton, less than one-third the price of September, 1872.

"'In the expansion which followed 1878, prices reached their maximum in the months of January, February and March, 1880; but the

highest figures were maintained only for a very short time. Anthracite foundry pig iron, which had fallen to $16.50 in November, 1878, rose to $41.00 in February, 1880; rolled bar iron to $85.12 in the same month; steel rails to $85; cut nails to $5.25 in the months of February and March. After the month of March, 1880, there was a sharp decline, though interrupted by numerous fluctuations. A steady decline began after the closing months of the year 1882, and continued until another minimum was reached in the summer of 1885. The crisis of May, 1884, occurred in the midst of this downward movement and seems to have exerted but little influence upon the iron market, Anthracite foundry pig iron fell to $17.75 in the months of June, July and August of 1885 and then began to rise. Rolled bar iron fell to $40.32 for the remaining months of the year. Steel rails fell to $26 in the month of April.

"'After the minimum point in 1885, there was an upward movement continuing until the earlier months of 1887, the months of February and March of that year showing maximum prices in most varieties of iron and steel; this maximum was succeeded by a fall in the prices, which for most varieties reached a minimum in May and June, 1889. This minimum was followed for a short time by rising prices, which reached a maximum in 1890. In the two decades after the maximum prices of 1880, the trend of prices differed from that in the preceding decade. Fluctuations were much more frequent and for nearly eighteen years the general tendency was downward, though interrupted by brief revivals in prices in the years 1882, 1886, 1887, 1890 and 1895. The rise in price which occurred in 1887 and other years proved to be greater than the increased demand would sustain. The general statement may be made that during this long period between 1880 and 1897, in fact until 1898, for there was only a slight rise in that year and the average price of several forms was less than in 1897, the demand did not keep pace with the increasing supply, and improvements in production were constantly exerting their influence. The increase in price in the United States in 1887 was greater than in other countries. The

reason for the difference may be found in the exceptional demands in the year 1887, in which year occurred the most extensive railway building and the greatest consumption of steel rails. There was an exceptional deficiency in the home supply. There was also a revival of general activity in this country, the effect of which was conspicuous. It should be further noted that the crisis of this decade was much less severe than that of 1873, and the downward movement succeeding it, though long continued, manifested less decline in prices.

"'After the high prices of 1890, there was a fall which continued until the month of July, 1897. This fall was more uniform than those after 1880 and 1887. It was interrupted only by a temporary revival beginning after April, 1895, and continuing until the latter part of the year.'

"Beginning in July, 1897, prices show an upward tendency, but increases were slight until the beginning of 1899; then there was a very rapid rise until the latter part of the year, which continued, with the exception of a very slight setback in 1903, to the depression of 1907-8.

"Again the improved conditions of 1909-10 were preceded by a remarkable increase in the price and production of iron, followed later by an increase in the production of copper and other commodities. From the high point of 1909-10, prices of iron and steel declined again to a low point in December, 1911, followed by a rapid advance in 1912.

"In the examination of these price movements several marked tendencies appear:

"'(1). The interval between the date of the maximum prices and the succeeding crisis is longer in the later years. This interval continued for a few months prior to the crises of 1825 and 1837, nearly a year prior to that of 1873, and several years prior to the crises of 1884 and 1893. This longer interval may be explained by the greater ability to carry accumulated stocks in expectation of a rise, the larger influence of speculation, and the

absorption whenever prices decline, of larger quantities by the market now existing.'

"These influences explain another tendency, viz.:

"'(2). In later years fluctuations are more frequent. In the period after the downward price movement has commenced the market price breaks and then is restored again. It is evident that abundant capital for construction is waiting for investment and even in case of a slight decline, purchases are large and tend to bring prices to the former level.

"'(3). Since 1873 the maximum price reached in each upward swing tends to be less than that in the preceding rise. This is due to invention, to the lower cost of manufacturing on a large scale, and improvements of transportation. This tendency to lower prices is a part of the progress of the time and an essential feature in each depression.

"'(4). The upward movement of prices continues for a much shorter time than the downward movement. The upward movement preceding the maximum of October and November, 1872, continued for one year and nine months. The succeeding downward movement lasted until November, 1878, or six years and one month. Then an upward movement continued until February, 1880, or one year and three months; the succeeding downward movement lasted approximately five and one-half years, to the summer of 1885, to be followed by a rising movement interrupted in the United States in 1888 and 1889, of four and one-half years, or until January, 1890. It is to be noticed, however, that the rise in most grades of iron and steel for a year after the summer of 1885 was very slight. After January, 1890, the downward movement continued for seven and one-half years, to July, 1897, when prices for a year were almost stationary, to be followed by rising prices, which continued until the end of 1899 or less than a year and a half.

"'(5). The rapid rise which precedes a maximum price rarely continues for more than a year. If we take anthracite and Bessemer pig-iron as the best standard, it will be noticed

that prior to the maximum price of anthracite, September, 1872, prices rose from $37 in January of that year; prior to the maximum of $41 in February, 1880, prices had risen rapidly from $20.75 in August, 1879, or for six months; prior to the maximum of $19.90 in January, 1890, there was a rise from $17 in May, 1889, or for eight months; prior to the maximum of $25 for Bessemer pig-iron in December, 1899, there was a rapid rise from $11 in January of the same year, or for eleven months. In many respects, the rise in 1899 was the most remarkable of all, because it had been considered by iron manufacturers in the preceding years that the equipment for production was sufficient to properly meet any increase of demand, and yet the rapid rise in that year was unprecedented. The great increase in the price of iron and steel in that year, with the steady increase in production after 1894, proves the more general use of these products for a greater variety of purposes and over an enlarged area.'

"For a general study of prices, Bradstreet's Index of American prices and the London Economist's Index of English prices, should be tabulated or plotted at regular intervals. It will be noticed in studying commodity prices, that the fall after a year of panic, curtailment and depression is usually considerably less than the preceding rise. For this fact there are several reasons:

"First. The continuous increase in the amount of active circulating medium. In normal conditions money is valued only as a means of purchasing goods. A certain amount must be kept as 'till-money' and for bank reserves. People only hoard money when they become frightened. Hence, an increased supply of money is ordinarily reflected in an increased demand for goods, resulting in higher prices (since there is no corresponding increase in the supply of goods offered).

"The output of gold which is being supplied at the rate of over one million dollars per day is directly responsible for much of the steady increase which has taken place in the

world's stock of money. Indirectly, it forms the basis for credit expansion, the effect of which is even more important. The financial history of the past sixty years has been characterized by a great expansion in the use of credit instruments, bank notes, treasury notes, and bank deposits, subject to check, act as a medium of exchange and thus perform the functions of money. Most checking deposits are created by loans made to enable the borrower to purchase goods, and therefore this credit money has the same effect on prices as the same amount of specie.

"Second. Another effect in maintaining high prices is the growing pressure of population on the land supply. The best mining and agricultural opportunities of the new world have been occupied. The insistent demand for raw material to clothe, feed, house, educate and amuse the steadily increasing population is continually forcing resort to less advantageous sites. These yield their product only at a higher cost per unit.

"A given area of land can be made to yield more grain per acre only by the use of more fertilizer or more thorough cultivation. After a certain point is passed, additional product per acre can be obtained only at a disproportionate additional outlay in labor or capital, or both. This will not be undertaken unless the price of the products is sufficient to justify it. The resort to poorer lands, and lands farther from the market will be undertaken only under the same condition.

"Broadly speaking, mining, the other great department of extractive industry, is governed by the same general principle. It is true that new and rich ore deposits are discovered from time to time, but the operation of extracting the product from known mines proceeds in a manner practically similar to the method of agriculture. Those deposits are worked first that can be worked at the lowest per-unit cost, and as these are exhausted, it becomes necessary to dig deeper into the ground, to extend

operations to less easily accessible territory, or to resort to poorer grade of ore. Increasing demand is thus constantly forcing prices to higher levels.

"Third. The maintenance of high prices is in part due to the rise of the standard of living which a period of increasing wealth first produces, and then establishes with a resisting power that even in times of depression resists with a new force any recession in its newly gained advantages.

"Fourth. There is a final factor behind existing price levels in the forms of the wastes due to war and the maintenance of great armaments, and in the millions of misdirected capital which have helped to enhance the costs of profitable production.

"Therefore, the price of commodities is one of the best of business barometers and all merchants and bankers systematically tabulate each month the "Index Number" compiled by Bradstreet or others, supplemented with figures on the price of iron, copper, cotton, etc. Such figures especially interest bankers since much more money is needed to finance a given volume of business with high prices than with low prices. Therefore, an increase in interest rates usually follows a decided advance in commodity prices.

"Students desiring a popular discussion of the subject are advised to read the report published by the State of Massachusetts on the "Increased Cost of Living" in May, 1910, - Robert Lucie Esq., Chairman.

"The most scientific discussion of prices may, however, be found in Prof. Irving Fisher's book, entitled 'The Purchasing Power of Money,' published by Macmillan & Co., New York. Professor Fisher deserves the very highest commendation for his original researches along these lines."[1]

[1] Reference #14 - pages 371-380

CHAPTER VIII

STATISTICS

Statistics has been defined as the mathematics of economics. This is true, and we can go even further and say that it is the mathematics of business not only of economics as generally thought of but also of finance, banking, and other affairs. The purchasing agent must use statistics in order to successfully record information which is of vital importance to him and to keep track of market conditions, budget allowances, price changes, inventories, and so forth. There is no need, perhaps, for him in all cases to be a highly trained mathematician familiar with algebraic and trigonometric formulae which may be used for advanced statistical work, but it is important that he know the more common forms of statistics in order that he may intelligently interpret the information which comes to his attention in statistical form.

It is important for him, for instance, to recognize that x'x ordinate simply refers to a horizontal ruling used to locate a point in plotting a curve and the y'y ordinate is a vertical line intended to do the same thing, and that O is a point of intersection along the x'x and y'y lines or else it is a point of origin from which additional points are plotted. In the main, statistical curves fall within three classes, the parabolic, hyperbolic, and exponential.

It does not seem necessary at this point to insert formulae for these curves for most of the statistical work the buyer is concerned with does not require the use of very great mathematics, and as this is not a thesis on statistics it is hardly necessary to devote much time to a subject so highly mathematical. It would seem that provided the buyer is familiar with the meaning of certain terms it will be possible for him to accomplish all that he desires satisfactorily. He should, for instance, know that the term median, the symbol for which is Md, refers to the point at which one-half the number of cases investigated are included and one-half excluded, or to put it another way one-half the cases are above and one-half below. Then too he should know that the term mode, the formula for which is Mo, is the value which occurs the greatest number of times. The third term he should be familiar with is the mean, the symbol for which is M. There are several varieties of this term and while geometric and harmonic means are used the more common one is the arithmetic mean. This is a calculated average which tends to show the center of gravity of a distribution. The formula to derive the mean is as follows:

$$M = \frac{(if\ m)}{N}$$

In the above formula sigma equals the sum, f the number of cases in a given class in a frequency distribution, and

m the value of the mid-point in a class while N is the number of cases. Another term which is almost self-explanatory is that of range, which is the rough measure of variation, in other words the difference between the smallest and the largest item in the distribution. Deviation is a term quite common in statistical work and refers to the measures of variations about a central value. Of much the same type are terms such as quartiles and deciles.

Before we can intelligently interpret statistics which come to our attention almost daily we must bear in mind that in the preparation of these charts the figures presented have ordinarily been doctored or as the statistician says weighted in order that they may be of more value. Let us assume for example that the number of articles bought is 100 and the price paid is $3 a piece. To plot this the quantity would be multiplied by the price giving a value of 300. Now suppose that 50 articles were bought at $4. The weighted value would then be 50 times 4 or 200. Had this article been plotted on the basis of price the quantity curve would have declined rapidly. If it had been plotted on the basis of price the curve would have gone up rapidly. But, by weighting, in other words putting the two factors price and quantity together, we have a curve which shows the relative value of the article as bought.

The following quotation from F. C. Mills' "Statistical Methods" will serve to show the more common forms of weighting simple commodity prices.

"I Each weight = base year price x base year quantity.

II Each weight = base year price x given year quantity.

III Each weight = given year price x base year quantity.

IV Each weight = given year price x given year quantity."[1]

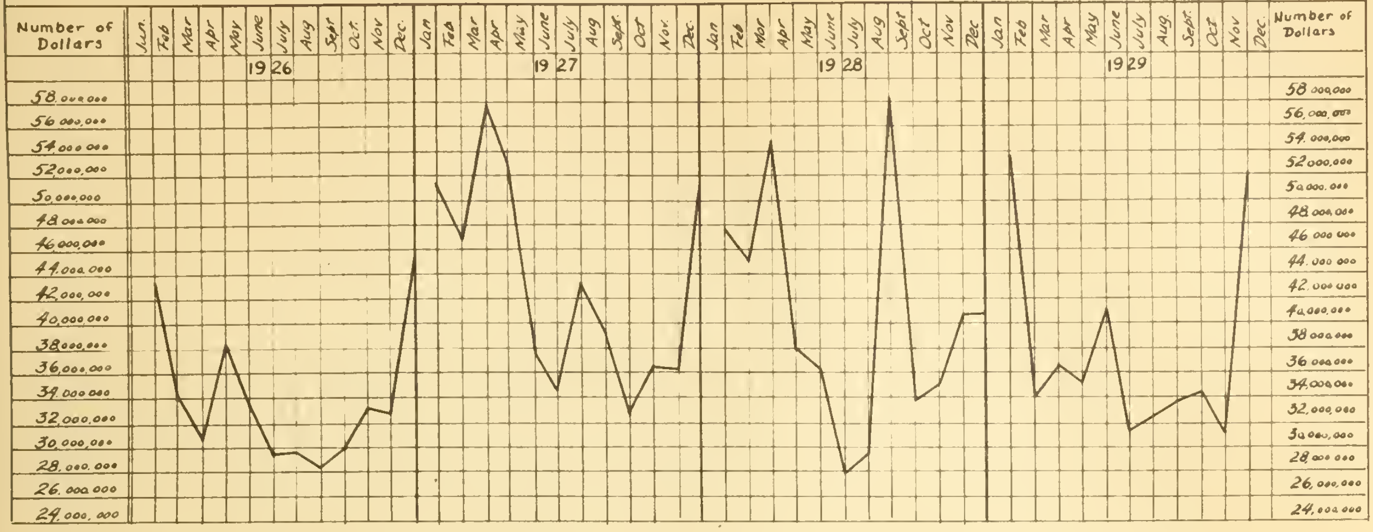
Index numbers of prices may be expressed in several different ways. First, for example, the consumption may be plotted in value or in quantity or some one year may be taken as a basic year with a relative of one hundred and then fluctuations in quantity may be expressed as a relative of the base year. Then it is possible when comparing several products to determine the relative production and weight this by the importance of that product in relation to the others. For example, bituminous coal is three times as important according to some statisticians as anthracite. Therefore, while the relative price of one may increase or decrease the weighted value used in plotting the commodity price would be three times the relative for bituminous and one times the relative for anthracite. The third form is the aggregate in which the items of the series are totaled and used as such instead of there being any attempt to strike an average.

The measurement of trend, especially secular trend, is of importance. The secular trend as explained in the

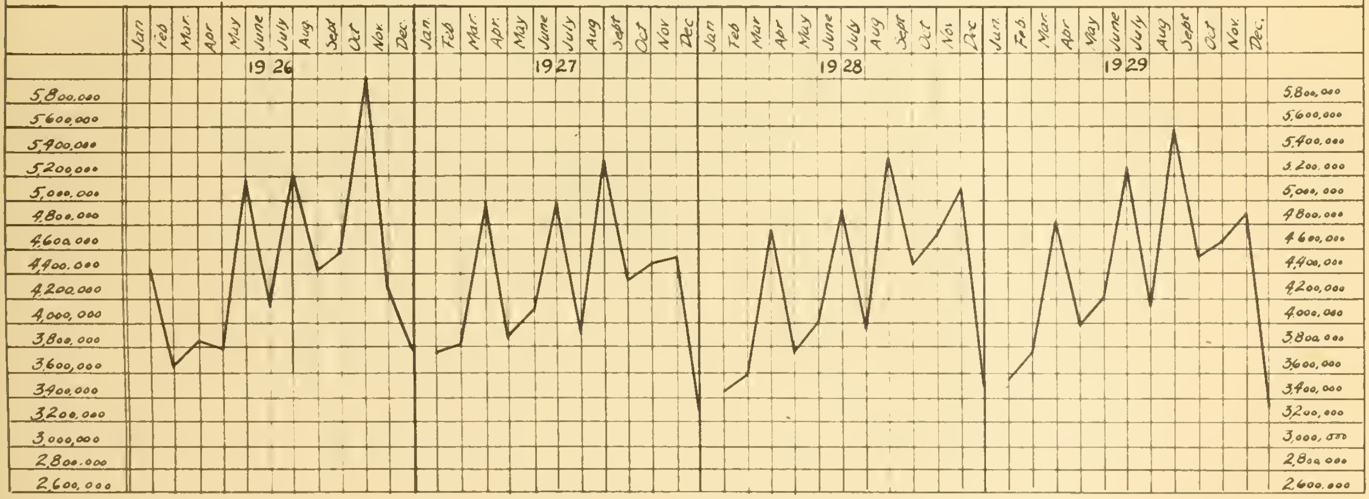
BUSINESS FAILURES IN THE UNITED STATES

(January 1926 - November 1929)

Data taken from "Dunn's Review"



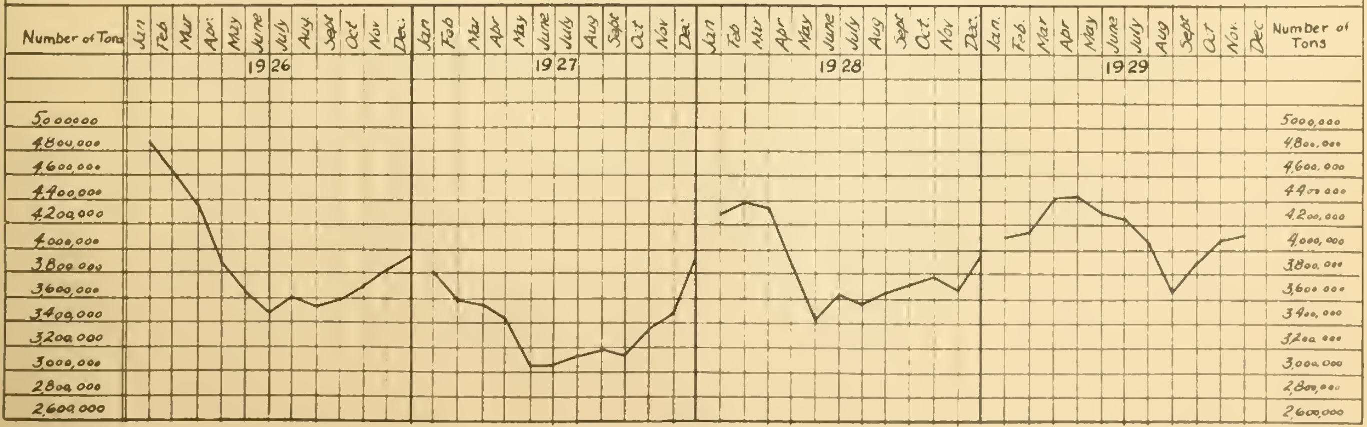
FREIGHT CAR LOADINGS



UNFILLED STEEL ORDERS OF THE U.S. STEEL CORP.

(January 1926 - November 1929)

Data taken from "Iron Age"



preceding chapter is the general tendency up or down over a long period of time. Many times an article will be gradually increasing in value but will suffer quite wide variations within a short period of time. Yet, taken over a period of years, the tendency is in one general direction and in an attempt to establish that general trend it is often necessary to smooth the curve which ordinarily would be reflected by plotting the prices or quantities at any particular period. I have plotted on the following page the secular trend of iron prices from 1861 to 1927 by two methods. The first is known as the moving-average method, which simply means that to plot the price of iron on January first we would if using a three year moving average find the average of the December first, January first, and February first prices and plot it. This combining of three prices tends to eliminate a still or temporary fluctuation, and it can readily be seen that if this moving average is changed from a three to a five, seven, or nine month average the curve would be smooth still more. The other curve I have plotted is the fitting of a straight line. It should be noted that while the five year moving average plotted smooths the curve the nine year moving average does it even more. To determine the straight line trend a special formula was used. This formula was taken from "Statistical Methods" by F. C. Mills.[1]

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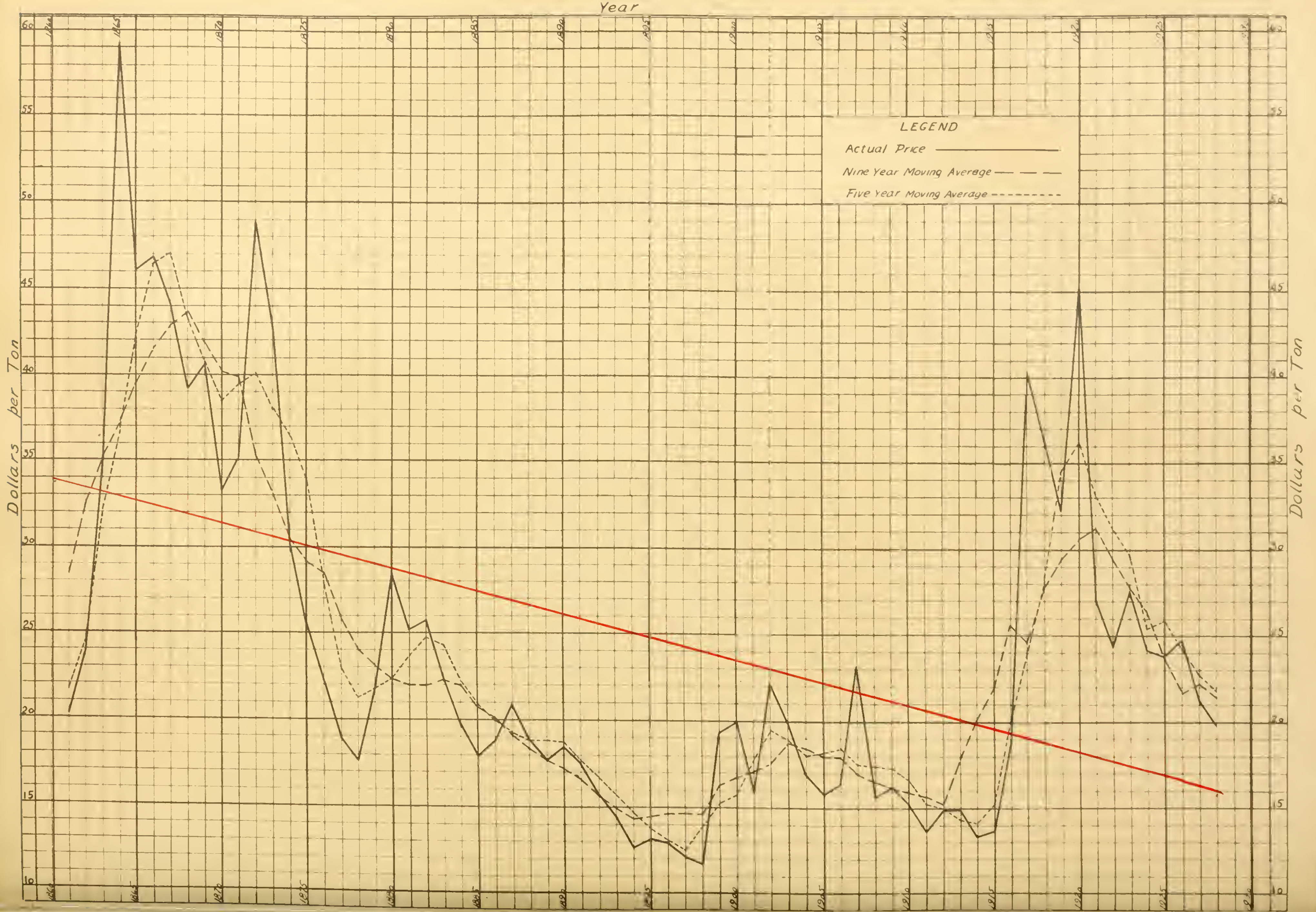
[1] Reference #15 - pages 273-280

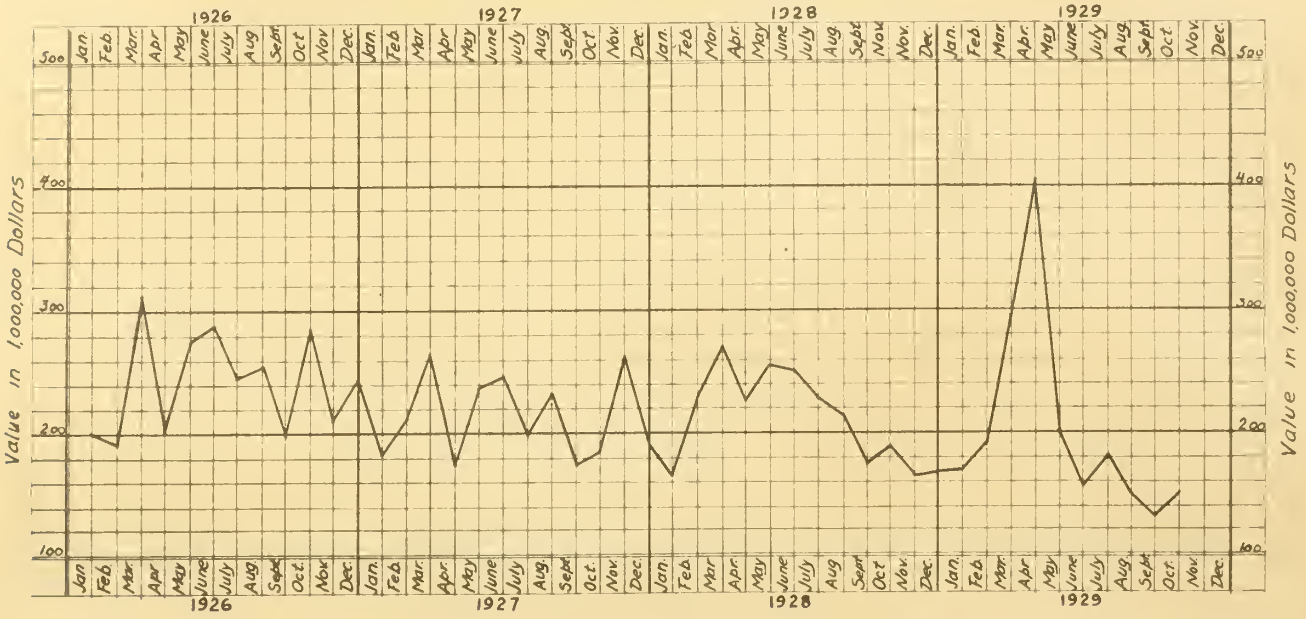
IRON PRICES


Year
Dollars per Ton
10
15
20
25
30
35
40
45
50
55
60
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
LEGEND
Actual Price ————
Nine Year Moving Average — — —
Five Year Moving Average - - - - - -

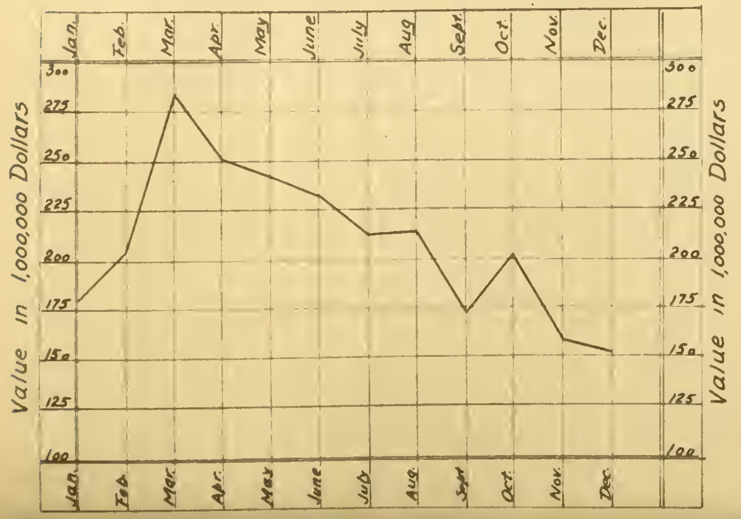
Another type of computation which must be considered is that to show seasonal fluctuations which is very important in measuring values of building construction, crops, and so forth. To do this I have used building construction values and have plotted these values on the following page using arithmetical averages and link relatives.

One very important thing for the statistician to keep in mind is that figures may appear at first to be telling the same thing, but what they say will be dependent upon the basis upon which they were computed. If we take the cost of living curves plotted by several different organizations we will find quite marked differences. Therefore it is important that the purchasing agent be sure that whatever figures he gathers from the outside for statistical purposes be gathered each week or month from exactly the same source. Otherwise they will be of little value to him. It is, of course, possible for a purchasing agent to determine what facts he wishes to gather and for him to interpret these facts in the light of his own experiences. In general, however, there are so many different ways of determining movements of prices, quantities, and so forth that on the following pages I have attempted to include statements from Roger Babson's book which give conclusions which may be drawn by reading statistical data and charts on items such as building operations, bank clearings, business failures,

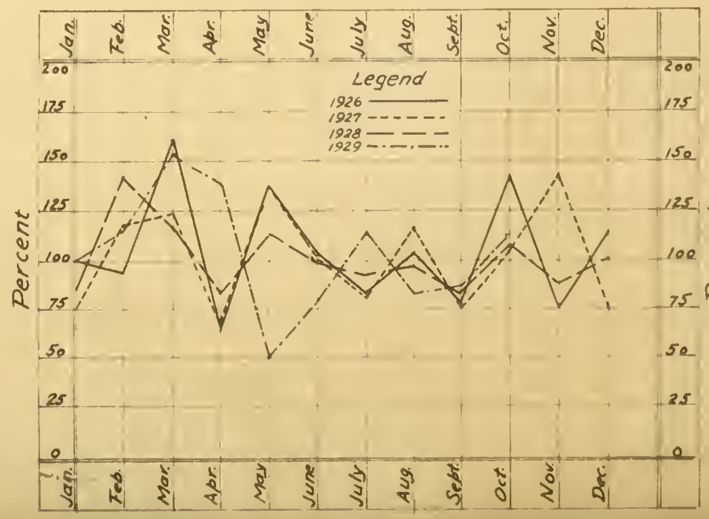
Building Construction



Four Year Arithmetic Average



Link Relatives



and so forth. If we should attempt to govern our actions upon information given by any one of these items, we would be permitting a serious mistake, but by considering business in the light of several of these facts we should be able to gather satisfactory and valuable information.

"The following are certain conclusions relative to Building Operations.

1. During a Period of Business Depression.
    (a) An increase forecasts better conditions.
    (b) A decrease forecasts continued depression.
    (c) No change signifies conditions to be stationary.
2. During a Period of Improvement Following a Period of Business Depression.
    (a) An increase forecasts a period of over-expansion.
    (b) A decrease forecasts a set-back.
    (c) No change suggests caution.
3. During a Period of Over-expansion.
    (a) A great increase suggests that over-expansion is nearing an end.
    (b) A decrease may tend to lengthen the period of over-expansion.
    (c) No change signifies conditions to be stationary.
4. During a Period of Decline Following a Period of Over-expansion.
    (a) An increase is indicative of further trouble.

(b) A decrease is natural under these conditions.

(c) No change suggest caution."[1]

"Conclusions Relative to Bank Clearings

1. During a Period of Business Depression.
   - (a) An increase signifies that trade is improving.
   - (b) A decrease signifies that trade conditions are growing worse.
   - (c) No change signifies that trade conditions are remaining fixed.
2. During a Period of Improvement Following a Period of Depression.
   - (a) An increase signifies that trade is continuing to improve.
   - (b) A decrease signifies that the improvement has temporarily been checked.
   - (c) No change shows that progress is very slow.
3. During a Period of Over-Expansion.
   - (a) An increase shows that trade conditions are very prosperous, although too great an increase under such conditions forecasts trouble.
   - (b) A decrease shows that a change is taking place and business is decreasing.
   - (c) No change at this point often is a sign that a change is about to take place.

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[1] Reference #14 - page 254

4. During a Period of Decline Following a Period of Over-Expansion.
    (a) An increase signifies a temporary check in the decline.
    (b) A decrease is the natural movement and signifies no improvement.
    (c) No change shows uncertainty or possibly serves to delay the coming depression."[1]

"The following conclusions are suggested relative to 'Business Failures'.

1. During a Period of Business Depression.
    (a) An increase signifies that the depression is not ended.
    (b) A decrease, after a large increase, signifies improvement.
    (c) No change signifies that caution is still necessary.
2. During a Period of Improvement Following a Period of Business Depression.
    (a) An increase in failures signifies that the improvement has been temporarily checked.
    (b) A continued decrease signifies continued improvement.
    (c) No change signifies that caution is still necessary.
3. During a Period of Over-expansion.
    (a) An increase in failures, especially of large concerns, forecasts a decline.

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1. Reference #14 - pages 263-264

(b) A great decrease signifies the need of caution.

(c) No change signifies nothing of importance.

4. During a Period of Decline Following a Period of Over-expansion.

   (a) An increase signifies no immediate improvement.

   (b) A decrease signifies a temporary check in the decline or an improvement.

   (c) If there is no change the figure need not be considered."[1]

"In the absence of war or other artifical restrictions the following conclusions have in former years been used when considering immigration figures.

1. During a Period of Business Depression.

   (a) An increase after a distinct decrease shows that conditions are improving.

   (b) A continued decrease signifies that as yet there is no improvement.

   (c) No change signifies that conditions are at a standstill.

2. During a Period of Improvement Following a Period of Business Depression.

   (a) An increase signifies continued improvement.

   (b) A decrease signifies no immediate improvement.

   (c) No change signifies no definite trend.

[1] Reference #14 - pages 274-275

3. During a Period of Over-Expansion

   (a) A great increase signifies no further improvement or a decline.

   (b) A decrease signifies that the corner is being turned and a decline may be expected, and thus calls for caution.

   (c) No change signifies continued improvement.

4. During a Period of Decline Following a Period of Over-Expansion.

   (a) An increase signifies a temporary improvement.

   (b) A decrease signifies no improvement.

   (c) No change signifies nothing definite."[1]

"The following conclusions may be of interest relative to net amount of working money in circulation.

1. During a Period of Business Depression.

   (a) An increase signifies declining money rates, and more satisfactory conditions.

   (b) A decrease signifies higher money rates, and less satisfactory conditions.

   (c) No change signifies nothing important.

2. During a Period of Business Improvement.

   (a) An increase forecasts better conditions.

   (b) A decrease forecasts a check or setback.

   (c) No change suggests nothing of importance.

3. During a Period of Over-expansion.

   (a) A large increase calls for caution.

[1] Reference #14 - pages 280-281

(b) A sudden decrease signifies higher money rates and forecasts reaction.

(c) No change signifies continued prosperity.

4. During a Period of Decline Following a Period of Over-Expansion.

(a) An increase checks the decline, but forecasts continued unsatisfactory conditions.

(b) A decrease forecasts higher money rates and continued decline.

(c) No change suggests caution."[1]

"The following conclusions regarding the ratio of 'Loans' to 'Aggregate Resources' are suggested. The same principles apply to the ratio of 'Loans and Investments' to 'Aggregate Resources.'

1. During a Period of Business Depression.

(a) An increase in the ratio signifies renewed activity.

(b) A decrease signifies a further recession in business.

(c) No change signifies continued dullness.

2. During a Period of Improvement Following a Period of Business Depression.

(a) An increase in the ratio signifies increased activity.

(b) A decrease signifies a temporary recession.

[1] Reference #14 - pages 288-291

(c) No change calls for special watchfulness.

3. During a Period of Over-expansion.
    (a) An increase in the ratio signifies that fundamental conditions are becoming unsound.
    (b) A decrease tends to prolong the period of over-expansion.
    (c) No change signifies nothing of importance.
4. During a Period of Decline Following a Period of Over-expansion.
    (a) An increase in the ratio signifies further trouble.
    (b) A decrease is the natural movement.
    (c) No change calls for special watchfulness."[1]

"The following conclusions are suggested relative to the ratio of reserves to deposits. In interpreting 'Reserve Ratios' account must be taken of abnormal gold holdings such as those built up following the year 1920. The ratio is of greatest importance in times of market strain.

1. During a Period of Business Depression.
    (a) An increase signifies lower money rates but continued dullness.
    (b) A decrease signifies higher money rates but improved conditions.
    (c) No change signifies continued dullness.

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[1] Reference #14 - pages 299-300

2. During a Period of Improvement Following a Period of Business Depression.
   - (a) An increase signifies that the recovery in business is not very marked, and that continued low money rates may be expected.
   - (b) A decrease signifies continued improvement and is the forerunner of higher money rates.
   - (c) No change signifies uncertainty.
3. During a Period of Over-expansion.
   - (a) A great increase signifies that prosperous conditions may be expected to continue, with no change in money rates.
   - (b) A great decrease is a danger signal and is always the forerunner of higher money rates.
   - (c) No change may signify either condition.
4. During a Period of Decline Following a Period of Over-expansion.
   - (a) An increase tends to prolong present conditions and to lower money rates.
   - (b) A decrease is a sign that conditions are growing worse. Higher money rates may be expected.
   - (c) No change signifies uncertainty."[1]

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[1] Reference #14 - pages 304-305

"The following conclusions relative to the ratio of either cash or reserves to deposits are suggested:

(These general principles also apply to the ratio of 'Reserves' to 'Aggregate Resources.')

1. During a Period of Business Depression.
    (a) After money has been cheap for some time, accompanied by large reserves, a continued increase in the ratio of 'Reserves' to 'Deposits' signifies that business remains at a stand-still.
    (b) A decrease - under the above conditions - may be good, showing that business is reviving.
    (c) No change signifies that conditions are stationary.
2. During a Period of Improvement Following a Period of Business Depression.
    (a) After money rates have been very low for some time, a further increase in the ration of 'Reserves' to 'Deposits' often means that there has been another recession in business.
    (b) A decrease under such conditions usually signifies renewed activity.
    (c) No change signifies a period of hesitation.
3. During a Period of Over-expansion.
    (a) An increase in the ratio of 'Reserves' to 'Deposits' tends to prolong the period of over-expansion.

(b) A decrease tends to shorten the period of over-expansion.

(c) No change signifies a period of hesitation.

4. During a Period of Decline Following a Period of Over-expansion.

(a) An increase in the ratio of 'Reserves' tends to delay the depression."[1]

"The following conclusions are suggested relative to 'Imports':

1. During a Period of Business Depression.

(a) A normal increase signifies nothing important, provided said increase does not adversely affect the balance of trade.

(b) A decrease signifies that fundamental conditions are improving.

(c) No change signifies nothing of importance provided the exports are likewise constant.

2. During a Period of Improvement Following a Business Depression.

(a) An increase, if not too great, is natural.

(b) A decrease signifies no immediate improvement.

(c) No change signifies nothing of importance, provided the exports are likewise constant.

3. During a Period of Over-expansion.

(a) An increase, especially if abnormally large, is

[1] Reference #14 - pages 309-310

a sign that over-expansion is nearing its end.

(b) A decrease tends to lengthen the period of expansion, and is therefore a sign of continued improvement.

(c) No change signifies nothing definite.

4. During a Period of Decline Following a Period of Over-expansion.

(a) An increase calls for caution.

(b) A decrease is only natural.

(c) No change calls for caution."[1]

"The following conclusions are suggested relative to 'Exports' and also relative to 'Volume of Foreign Trade':

1. During a Period of Business Depression.

(a) An increase signifies an improvement.

(b) A decrease signifies no improvement.

(c) No change calls for caution.

2. During a Period of Improvement Following a Business Depression.

(a) An increase signifies continued improvement.

(b) A decrease signifies no improvement.

(c) No change signifies nothing definite.

3. During a Period of Over-expansion.

(a) An increase signifies continued improvement.

(b) A decrease signifies no further improvement.or that a decline may be expected.

(c) No change calls for caution.

4. During a Period of Decline Following a Period of Over-expansion.
   - (a) An increase signifies an improvement.
   - (b) A decrease signifies no improvement.
   - (c) No change calls for caution."[1]

"The following conclusions relate to the 'Balance of Trade in favor of the United States'.

1. During a Period of Business Depression.
   - (a) An increase signifies an improvement.
   - (b) A decrease signifies no improvement.
   - (c) No change signifies that money rates may depend largely on domestic conditions.
2. During a Period of Improvement Following a Period of Depression.
   - (a) An increase signifies continued improvement.
   - (b) A decrease signifies no improvement.
   - (c) No change signifies that money rates may depend largely on domestic conditions.
3. During a Period of Over-expansion.
   - (a) An increase signifies continued improvement.
   - (b) A decrease signifies that the end of the period of prosperity is approaching.
   - (c) No change signifies nothing of importance.
4. During a Period of Decline Following a Period of Over-expansion.
   - (a) An increase signifies that lower money rates may

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[1] Reference #14 - Pages 339-340

be expected, and the end of the decline.

(b) A decrease signifies continued decline.

(c) No change signifies nothing of importance."[1]

1. During a Period of Business Depression.
    - (a) An increase in gold exports forecasts an increase in money rates and suggests caution.
    - (b) A decrease forecasts lower money rates and no improvement.
    - (c) No change is unfavorable or favorable according to whether gold is being exported or imported.
2. During a Period of Improvement Following a Period of Depression.
    - (a) An increase forecasts an increase in money rates but usually retards the improvement.
    - (b) A decrease signifies continued improvement and forecasts lower money rates.
    - (c) No change is unfavorable or favorable, according to whether gold is being exported or imported.
3. During a Period of Over-expansion.
    - (a) An increase signifies no improvement and, if continued over a long period, foretells the end of the period of over-expansion.
    - (b) A decrease signifies continued improvement, but any exportation of gold should be considered as unfavorable.

[1] Reference #14 - pages 342-343

(c) No change calls for caution.

4. During a Period of Decline Following a Period of Over-expansion.
    (a) An increase signifies no improvement and often calls for caution.
    (b) A decrease is the normal result of a decrease in activity.
    (c) No change is unfavorable or favorable according to whether gold is being exported or imported."[1]

"The following conclusions are suggested relative to 'Foreign Money Rates,' as expressed in figures of foreign conditions:

1. During a Period of Business Depression.
    (a) An increase in foreign money rates usually signifies higher domestic rates.
    (b) A decrease signifies no improvement.
    (c) No change signifies 'no change.'
2. During a Period of Improvement Following a Period of Depression.
    (a) An increase in foreign money rates or in foreign exchange usually forecasts higher domestic money rates, and may retard further improvement.
    (b) A decrease is favorable.
    (c) No change signifies normal conditions.

[1] Reference #14 - pages 354-355

3. During a Period of Over-expansion.
    - (a) An increase in foreign money rates or in foreign exchange usually forecasts higher domestic rates, and signifies over-expansion is nearing its end.
    - (b) A decrease signifies continued improvement.
    - (c) No change means normal conditions.
4. During a Period of Decline Following a Period of Over-Expansion.
    - (a) An increase in foreign money rates or in foreign exchange usually forecasts higher domestic money rates, and further trouble.
    - (b) A decrease signifies the reverse, providing all other factors remain constant.
    - (c) No change signifies normal conditions."[1]

"The following conclusions are suggested relative to 'Gold Production':

1. During a Period of Business Depression.
    - (a) A great increase tends at first to lower money rates, and to cause an improvement.
    - (b) A great decrease tends to increase money rates, and may signify no immediate improvement.
    - (c) No change signifies that money rates will be determined wholly by outside conditions.
2. During a Period of Improvement Following a Period of Depression.
    - (a) A great increase tends at first to lower money

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[1] Reference #14 - pages 361-362

rates (although the later effect may be the reverse) and signifies continued improvement.

(b) A great decrease tends to increase money rates, and signifies no improvement.

(c) No change signifies that money rates will be determined wholly by outside conditions.

3. During a Period of Over-expansion.
    (a) A great increase is very dangerous and calls for caution.
    (b) A great decrease tends to upset conditions and also calls for caution.
    (c) No change signifies that money rates will be determined wholly by outside conditions.
4. During a Period of Decline Following a Period of Over-expansion.
    (a) A great increase tends to retard the re-adjustment.
    (b) A great decrease tends to hasten the re-adjustment.
    (c) No change signifies that money rates will be determined wholly by outside conditions."[1]

"The following conclusions are suggested relative to 'Stock Exchange Prices' in times of normal money supply.

1. During a Period of Business Depression.
    (a) An increase is a distinctly favorable sign that better trade conditions may be expected.
    (b) A decrease signifies continued dullness.

[1] Reference #14 - pages 370-371

(c) No change signifies uncertainty.

2. During a Period of Improvement Following a Period of Business Depression.
   (a) An increase signifies continued improvement.
   (b) A decrease signifies no improvement.
   (c) No change signifies no improvement.
3. During a Period of Over-expansion.
   (a) A great increase usually is a very unfavorable sign and calls for caution.
   (b) A great decline calls for caution.
   (c) No change signifies temporary uncertainty.
4. During a Period of Decline Following a Period of Over-expansion.
   (a) An increase signifies a temporary halt in the decline.
   (b) A decrease forecasts further depression.
   (c) No change signifies temporary uncertainty."[1]

"The reason for studying the subject of 'New Listings' may be understood by a review of the three following laws of economics:

1. During a Period of Over-expansion, as the number of new companies, new promotions and new securities listed increase, the danger of a reaction increases and the danger of a reaction increases and the time between

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[1] Reference #14 - page 386

said Period of Over-expansion and future Period of Depression decreases.

2. When the number of new promotions, new companies and new listings is at a minimum, financial depression is sure to be reaching an end.
3. As the number of new companies, new promotions and new listings increases from a minimum, the gradual increase is a sign of improved conditions until the normal number of new companies, new promotions and new listings is reached, after which an increase again becomes a source of danger."

"The following conclusions are suggested relative to 'New Securities'.

1. During a Period of Business Depression.
    (a) An increase signifies improvement.
    (b) A decrease signifies no improvement.
    (c) No change signifies nothing important.
2. During a Period of Improvement Following a Period of Business Depression.
    (a) An increase signifies continued improvement.
    (b) A decrease signifies no improvement.
    (c) No change calls for caution.
3. During a Period of Over-expansion.
    (a) An increase, especially if great, is a sign of the culmination of the period of prosperity.

1. Reference #14 - page 387

  - (b) A decrease tends to lengthen this period of prosperity and thus signifies continued improvement.
  - (c) No change usually calls for caution.

4. During a Period of Decline Following a Period of Over-expansion.
   - (a) An increase signifies no improvement.
   - (b) A decrease indicates that conditions are naturally adjusting themselves.
   - (c) No change signifies no improvement, if large issues are still being offered, but otherwise it shows nothing of importance."[1]

"The following conclusions are suggested relative to 'Crops and other Commodities':

1. During a Period of Business Depression.
   - (a) Improved crop conditions are often the beginning of a period of improvement.
   - (b) Poorer crop conditions delay an improvement in general business, or signify no improvement.
   - (c) No change is favorable or unfavorable according as to whether this means good crops or otherwise.
2. During a Period of Improvement Following a Period of Depression.
   - (a) Improve crop conditions always give an impetus to the general improvement in conditions, and thus signify continued improvement.

[1] Reference #14 - pages 389-390

(b) Poorer crop conditions usually signify no improvement.

(c) No change is favorable or unfavorable according to what it represents.

3. During a Period of Over-expansion.

(a) Improved crop conditions tend to lengthen the period of prosperity; but bumper crops often precede a decline.

(b) Poor crop conditions tend to shorten said period, and signify no improvement.

(c) No change is favorable or unfavorable according to what it represents.

4. During a Period of Decline Following a Period of Over-expansion.

(a) Improved crop conditions sometimes tend to forestall a panic and promote an improvement.

(b) Poor crop conditions tend to hasten said time and perhaps cause a panic.

(c) No change is or is not of importance according to what it represents."[1]

"The following conclusions are suggested relative to 'Railroad Earnings':

1. During a Period of Depression.

(a) An increase signifies that conditions are improving.

[1] Reference #14 - pages 405-406

(b) A decrease signifies no improvement.

(c) No change usually signifies uncertainty.

2. During a Period of Improvement Following a Period of Depression.

(a) In increase signifies that the improvement in conditions is progressing satisfactorily.

(b) A decrease signifies no improvement, or that the improvement is temporarily checked.

(c) No change signifies nothing definite.

3. During a Period of Over-expansion.

(a) A great increase usually signifies the culmination of the period of prosperity.

(b) A decrease during a period of prosperity is practically impossible.

(c) No change calls for caution.

4. During a Period of Decline Following a Period of Over-expansion.

(a) An increase signifies a more gradual decline.

(b) A decrease signifies that conditions are rapidly becoming worse.

(c) No change signifies nothing definite."[1]

"Revenue Freight Car Loadings figures are of even more direct interest in forecasting business conditions than are figures on 'Railroad Earnings'. In fact, they bear the same

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[1] Reference #14 - pages 413-414

relation to railroad earnings that the Government crop estimates bear to the final figures compiled after the crop has been gathered.

The car loadings data are collected by the American Railway Association which receives every week from the officials of each railroad the reports of revenue freight cars loaded, divided as grain, live stock, coal, coke, forest products, ore, merchandise in less than carload lots, and miscellaneous loadings. Not only are the loadings for the different classes of freight available as given below, but the data by territorial divisions are also given. Car loadings often continue heavy after new orders for goods have begun to fall off and vice versa. In other words, car loading figures represent the movement of goods which have been manufactured during the three or four months preceding.

These reports on revenue freight cars loaded are especially valuable because of the prompt indication given by changing conditions. They are available ten days after the close of each week.

It takes about a month for a car to be taken from a siding, looked over, loaded, delivered and unloaded, and furnish its revenue. Then as the railroads do not publish the earnings of a car for about a month or more after received, it may be two or three months after a car is taken

from the siding before the earnings appear in the monthly statement of the railroads."[1]

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[1] Reference #14 - pages 414-415

CHAPTER IX

FINANCE IN PURCHASING

Financial problems which are of particular concern to the purchasing agent are of a much broader scope than is often considered to be the case. Too many people in managerial and executive positions seem to think that the only problem of the purchasing agent is to buy goods at the cheapest price, overlooking such important elements as the appropriateness, utility, and service of the articles purchased and of even greater importance not realizing that the purchasing agent can make or break the financial policies of the organization.

There are several ways in which this can be done. Several times mention has been made of the costof inventories. These inventories, which in a manufacturing concern are naturally divided into three classes, namely those of raw materials, goods in process, and finished goods, represent large amounts of capital many times tied up in a form which is really unmarketable. Of course, finished goods in theory and in practice should be worth what has been put into them in the way of labor, material, and carrying charges, and if production has been scientifically handled and if the sales organization is efficient and there is a demand for the goods, then this inventory should in a fairly short time be

convertible into cash or receivables. There are, of course, times when there is no market for the articles and although the value has been put into the goods it cannot be gotten out without suffering a loss.

When we come to considering the goods in process inventories we are coming in contact with a group of articles which simply amount to spoiled raw material as far as their value to anyone other than our own concern. Here again, if marketing conditions are right, it will be possible by expending a little more in the form of labor or added material to convert these goods in process into finished goods and then to in course of time turn them into cash or receivables. When we go back to the other class of inventory and consider the raw materials themselves we have a product which might be salable in an emergency to other concerns but as in the case of almost any forced sale the return received would not be very large. Of course, one might say that a going concern is not interested in forced sales and that no well-managed concern will carry a large inventory of goods in process and finished goods unless there is demand for the articles. They, of course, will not do so if they forecast conditions correctly but history is full of cases where supposedly well-managed concerns found themselves caught in situations similar to these.

Now it is perfectly true that the quantity of finished goods which are to be carried calls for the attention of the sales department and production department. The purchasing agent himself is not directly responsible for this inventory. On the other hand, the quantity of merchandise which is to be carried in raw form and many times in semi-finished form is the problem of the purchasing department. It will naturally be the tendency of the shop force to demand fairly large inventories in order to avoid the possibility of running out of materials which would result in a disruption of the production schedule. It is the job of the purchasing agent to make sure that the lowest possible quantities are carried in stock consistent with the production schedule and the condition of the market. Regardless of how enthusiastic the sales organization may be as to the future sales of the concern and regardless of how urgent they may be concerning the need for heavy production, let us say during a period of prosperity and inflation, it is the purchasing agent's duty to maintain the smallest possible inventory and to do the buying as near as possible on a hand to mouth basis. If he does this, he will not find his store room filled with high-priced materials when the crash in market prices comes. If he does not do it, he will probably find that a large amount of the merchandise carried will be used in producing goods which will later

be sold at a loss simply because of the change in market conditions from the time the raw materials were purchased to the time the finished goods were sold.

The cost of carrying an inventory is large. If we consider the percentage of floor space devoted to stock and receiving rooms and prorate to them the cost of rent, taxes, interest, insurance, and so forth and then take into consideration the cost of equipment in the form of bins, shelving, trucks, conveyors, and so forth we can appreciate that we have a large fixed cost. Then, too, if we remember that the size of the store room is in proportion to the volume of the stores we can see how greatly the cost of the inventory is increased by simply the cost of the store room itself. Let us add to this figure the cost of the material not only the building cost but the interest carrying charges which must be paid in order to finance the purchasing department and one can appreciate the enormous amount of money tied up in inventory.

If we would divide the liquid capital into two classes, namely the circulating, which represents the amount of capital invested in inventories, receivables, and so forth, and also the working capital, which is the own capital in that it is the amount of the company's own money devoted to the operation of the business as far as the current assets are concerned, we will be able to appreciate the importance

of reducing as far as possible the amount of money tied up in circulating assets, for the interest item involved will be in direct proportion to their total. Every dollar paid out in interest to banks, note brokers, discount houses, or creditors is simply a diversion of something that might be profits if it were not interest.

Another factor which often has considerable effect upon financial problems is the treatment of waste material. In many firms it is a practice to gather all waste, throw it into a general pile, and sooner or later have it hauled away to a dump or other place of disposal. Other concerns expend a little money and sort out of the general debris one, two, three, or four waste materials such as lead, cast iron, scrap steel, composition chips, and so forth. Other concerns find it to their advantage to very carefully collect and sort all waste. Then instead of simply selling it or giving it away they definitely look for a market for it first determining whether or not there is any possible use for it in their own plant. Of course, the amount of attention which will be paid to scrap will depend largely upon the type of organization in question but simply because it is waste product is no reason why it is valueless and purchasing agents must take it upon themselves to ascertain whether or not there is a possible use for the merchandise.

Some purchasing agents have found it helpful to plan buying program at some particular period in the month, that is between the 10th and 15th they will attempt to replenish the stock sufficiently to carry over at least one or two more months. This is done in order that it will not be necessary to place a lot of small orders as the expense or freight on small lots is much more in proportion than it is on large. Then,ttoo, it is often possible to obtain a better price when buying in larger quantities.

The purchasing agent should be interested not only in the financial resources of his own concern but in the financial resources of those with whom he does business. He should know what their credit is, their reliability and their policy toward customers in the matter of keeping their obligations on contracts involving penalty clauses, sliding price scales, and so forth. He should also know thoroughly the financial resources and policies of hiw own concern as without this information he cannot work effectively. If, for instance, the financial department will be able to take advantage of cash discounts at a certain period of the year he should keep this in mind and buy if possible with advanced datings or at a period when it will be possible for them to make the savings from cash discounts.

This brings us to the question of budgetary control. It is perfectly obvious that to control the operations of

a concern by a budget it will be necessary for each department to prepare its budget requirements and submit them to a committee whose work it will be to coordinate and weld into one whole the data submitted by the various forces. The purchasing agent's budget naturally will depend somewhat upon that of the sales force as his problem will be to acquire material early enough in the season that the goods may be manufactured and ready for delivery when sales are made. He cannot intelligently prepare that budget unless he knows when the selling loads appear in the sales department records. In addition, this question of ability to meet current policies, which is primarily the problem of the financial department, is also of importance to the buyer in order that he may cooperate with the treasurer to the fullest degree. In preparing the budget having these and similar facts in mind the purchasing agent should indicate the value of the estimated requirements of his department for materials, supplies, equipment, and office expenses. This estimate should be based on monthly or weekly figures and as expenses are incurred they should be tabulated and the actual expenditures compared with the estimate. Many concerns operate on the basis of monthly figures. They prepare the budget for a year in advance and then as one month is completed they add another on thereby always keeping a twelve-month budget in advance. This is ideal and in

the past has been considered sufficient, but there seems to be recognition lately in some quarters that there are cases when it is better to divide the monthly budget into weekly or ten-day periods in order that fluctuations may be watched even more closely. The whole problem of budgeting is interesting and important and in no department can be made more valuable than in the purchasing department. The fact that it is a budget of income makes it necessary to watch out more carefully than might otherwise be the case.

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